UNCLASSIFIED

NAVSHIPS 93301

Non-Registered

TECHNICAL MANUAL

for

RADIO SET AN/FRC-59

MOTOROLA INC.
COMMUNICATIONS AND INDUSTRIAL ELECTRONICS DIVISION
4501 W. AUGUSTA BLVD.
CHICAGO 51, ILLINOIS

DEPARTMENT OF THE NAVY
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Contract: NObsr 71897
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FOREWORD

PURPOSE OF THE MANUAL

This manual offers the technician complete installation, operation, maintenance and service information on the MOTOROLA 2-way radio models described in it.

The manual will serve not only as a ready reference for the experienced technician, but also as a step-by-step guide for the inexperienced man.

For convenience and quick reference, the manual is divided into separate sections. Each section has complete alignment, service and maintenance information on its chassis and/or kits and includes its own diagrams, details and parts lists. For example, the receiver section contains complete information on the receiver models. Installation and operation of the complete radio set are covered in a separate section. All major section paragraph headings and diagrams are listed for the technician's use in the Table of Contents.

BASE STATION NOMENCLATURE

MOTOROLA Base Stations have specific model nomenclature assigned. Model numbers define the equipment precisely in a few letters. In any correspondence with MOTOROLA about your equipment refer to it by model number to insure correct identification. A model number identification plate is fastened to the top of the front door of each base station cabinet.

MOTOROLA transmitters, receivers, power supplies and other units are also identified by model numbers. These numbers are stamped in a prominent place on each chassis. Use the chassis model number when referring to the manual or schematic diagram and in correspondence about your equipment.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected, e.g.; TA140BWQ-N becomes TA140BWQN-1 with the first revision. This model number complete with revision numeral is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis. The applicable issue letter is stamped on the chassis.

INSTRUCTION MANUAL REVISION BULLETINS

Changes which occur after an instruction manual is printed are covered by the Instruction Manual Revision Bulletins. These bulletins give the reader complete information on the change including pertinent parts list data from which the instruction manual can be corrected.

NATIONAL SERVICE ORGANIZATION

MOTOROLA provides a nation-wide service organization to assure availability of reliable maintenance at all times. These privately-owned and operated factory authorized service stations are equipped and qualified to handle complete installation of all MOTOROLA two-way radio equipment. They are also equipped and licensed to make the frequency and modulation measurements required by the FCC. Each station has the precision test equipment, stocks of replacement parts, and shop facilities necessary to maintain your system to factory specifications. Call on them for complete maintenance service! Consult your local telephone directory for the address of the nearest MOTOROLA Service Station, or write to:

National Service Manager
Motorola Communications and Industrial Electronics Inc., 4501 W. Augusta Boulevard, Chicago 51, Illinois

REPLACEMENT PARTS ORDERING

MOTOROLA maintains parts and service depots in Dallas, Texas, and Burlingame, California, to supplement the activities of the Parts and Service Department in Chicago. The following table outlines the services provided by these facilities:

Area Served	Parts and Service	Crystals	Resonant Reeds
Central and Eastern area	Chicago Parts Dept	Factory	Factory
Southern area	Dallas	Factory	Dallas
Western area	Burlingame	Factory	Burlingame

Addresses:

Factory: Crystal Service Department,
916 N. Kilbourn Ave.,
Chicago 51, Illinois

Chicago Parts and Service Department:
4910 West Flournoy Street
Chicago 44, Illinois

Dallas Parts Depot:
7138 Envoy Court,
Dallas 35, Texas

Burlingame Parts Depot:
1616 Rollins Road,
Burlingame, California

These offices are fully equipped to give this service. When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal type number, crystal frequency, carrier frequency and the chassis model number in which the crystal is to be used.

Orders for VIBRASENDER and VIBRASPONDER Resonant Reeds should specify the type number, and frequency and should identify the owner and operator of the PRIVATE LINE network in which these items are to be used.

NOTE

Naval activities shall requisition repair parts, electron tubes, semi-conductor devices, and quartz crystals through established supply channels for electronic material.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U. S. PATENTS:

RE-24,110	2,547,023	2,608,649	2,699,425	2,770,721
D-159,182	2,547,024	2,626,384	2,705,281	2,777,950
2,343,115	2,547,025	2,636,652	2,713,664	2,784,263
2,404,359	2,547,026	2,637,782	2,731,555	2,799,001
2,409,139	2,547,027	2,650,333	2,738,466	2,799,010
2,439,408	2,560,320	2,652,542	2,740,891	2,799,832
2,439,412	2,566,759	2,652,543	2,743,144	2,808,507
2,459,675	2,583,032	2,662,942	2,743,361	2,809,236
2,472,021	2,602,842	2,688,059	2,750,451	
2,524,300	2,607,818	2,691,094	2,759,052	
2,524,534	2,608,648	2,691,560	2,759,103	

Other U. S. Patents Pending

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DESCRIPTION

1. RADIO SET DESCRIPTION

Radio Set AN/FRC-59 (MOTOROLA Model X53GAB-1) is a 132-152 mc FM base station radio equipment consisting basically of the transmitter, receiver and power supply chassis assembled in an all-weather outdoor type metal cabinet. With associated accessories, this model provides dependable two-way communications with mobile and/or base stations. The receiver, transmitter and power supply chassis (RT-458/FRC-59) described herein are designed to operate from a 117 volt, 60 cycle primary power source.

This model is designed for a fixed installation remotely controlled from a Control, Radio Set C-2351/FRC (MOTOROLA Model TA270-N) Remote Control Console.

2. UNIT DESCRIPTION

a. Transmitter Chassis

The MOTOROLA Model TA192-N Transmitter Chassis provides 50 watts r-f output power from its final stages while operating within the 132-152 mc range.

Refer to the TRANSMITTER section of this instruction manual for specifications and service information relative to the transmitter.

b. Receiver Chassis

The MOTOROLA Model TA140BWQ-N Receiver Chassis is used in the 132-152 mc base station application together with the TK319-N Receiver Adapter Bracket, which adapts the receiver chassis for mounting in the base station cabinet.

Refer to the RECEIVER section of this instruction manual for further information on the receiver.

c. Power Supply

The MOTOROLA Model P-8066N-N Remote Supply Chassis converts 117 volts 60 cycle primary input to the various dc and ac voltages necessary for operation of the 50 watt transmitter and the superheterodyne FM receiver.

Refer to the POWER SUPPLY section of this manual for output ratings and schematic information on this chassis.

d. Remote Control Chassis

The MOTOROLA Model P-8066N-N Remote Control Chassis provides those facilities necessary for operation of the base station installation from a remotely located control console.

Refer to the REMOTE CONTROL CHASSIS section of this manual for servicing and detailed descriptive information.

e. Cabinet

The base station radio equipment is housed in the MOTOROLA Model TK592-N Weatherproof cabinet. The cabinet is a welded steel, completely weatherproof housing fitted with rugged key-locked doors at front and rear. Dimensions are 54" high, 20" wide and 18" deep. A set of louvres on each side near the top provides ventilation for the equipment. Each of the louvre sets has a cover which either screens the louvre or covers it completely. Additional ventilation is

obtained by uncovering a screened opening in the base of the cabinet.

f. Cabinet Accessory Kit

The MOTOROLA Model TK595-N Cabinet Accessory Kit is designed to facilitate the installation of the base station cabinet and its equipment. This kit includes the necessary chassis mounting hardware.

g. Audio Panel

The MOTOROLA Model TU582 Audio Panel includes a speaker with its associated hardware, a speaker "on-off" switch and a volume control. This speaker is designed to mount on the base station cabinet in order to provide monitoring facilities for the servicing technician.

h. Cable Kit

The MOTOROLA Model K-8682-N Cable Kit provides the necessary power interconnect cables for the transmitter and receiver units, as well as the antenna lead in cable and power supply cable.

Refer to the intercabling diagram included with this manual for information on the wiring and use of these cables.

i. Spare Fuse and AC Outlet Panel

The MOTOROLA Model P-8659-C Spare Fuse and AC Outlet Panel is a metal plate installed in the base station cabinet. It incorporates a dual ac convenience outlet and one set of spare fuses for the complete equipment.

Refer to the intercabling diagram in this manual for schematic details.

j. Tuning Tool Kit

The MOTOROLA Model K-9322 Tuning Tool Kit contains one nylon tuning instrument for the alignment of the receiver and transmitter units.

Refer to Diagram No. 69A849899 in this manual for details and part number.

k. Microphone

The M-90/U (MOTOROLA Model TU351A-N) Dynamic Microphone with built-in transistorized pre-amplifier and 4-prong connector is designed for use by the servicing technician in controlling the base station transmitter from the cabinet. The microphone connector is plugged into a receptacle on the power supply chassis and allows the technician to key the transmit-receive relay from the microphone push-to-talk button.

3. CRYSTALS

The base station radio set uses three crystals in its receiver and transmitter units. The crystals and their functions are as follows:

FUNCTION	TYPE	
	Military	Motorola
Transmitter control	CR-27/U	R03
Receiver control	CR-32/U	RM25
Receiver i-f control	CR-18/U	G03

INSTALLATION AND OPERATION

IMPORTANT

When a transmitter is initially installed, a suitable procedure shall be employed to ascertain that the carrier is on the assigned frequency. This frequency check is recommended to be made immediately before the equipment is placed in service. A MOTOROLA F4MU-24B Series Frequency Monitor, Frequency Counter AN/USM-26 plus frequency range extending converters covering 132-152 mc or equivalent frequency measuring device should be used for this purpose.

REMEMBER

The efficiency of the equipment depends upon a good installation.

1. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the damage as required by applicable BUSANDA instructions.

2. ANTENNA

Antenna AT-853/FRC59 (MOTOROLA Model DS9664) Unipole Antenna is a folded radiator type antenna with four ground plane rods at its base. This antenna is designed to mount on a support pipe with two clamps supplied for this purpose.

A coaxial lead-in transmission line is used to couple the signal between the radio set and the antenna.

3. INSTALLATION OF UPRIGHT CABINET

a. Location

(1) Mounting

The weatherproof cabinet is designed for exposed, all-weather installations. It can be mounted on a platform on a pole or installed on a flat roof, next to a building wall, etc. The cabinet should be mounted securely using the holes in the base or by installing heavy brackets to the sides.

(2) Entrance of the AC Line, Ground Lead and Control Line

There are knockouts in each side of the cabinet near the bottom. Select the knockouts nearest to the AC outlet, ground connections, etc. When punching out knockouts it is best to hold a short piece of 1-1/2" pipe against the inside of the cabinet behind the knockout. As an alternative to punching them out, the knockouts can be drilled out if desired.

(3) Entrance of the Antenna Transmission Line

There are knockouts in the top of the cabinet and in the lower left hand side (as viewed

from the rear). Use the most convenient knockout.

(4) Door Opening Space

Place the cabinet where there is 19" clearance for opening the doors.

(5) Elevation

There is a screened vent in the bottom of the cabinet. Mounting the cabinet on blocks approximately 2" above floor level will improve ventilation. Such an elevated mounting also keeps the cabinet out of surface water. Mount the cabinet where it will never stand in water.

b. Mechanical Checks

Check all cable lugs and connectors, fuses and all bolted connections. Be sure that all tubes are firmly in place.

c. External Connections

(1) Antenna and Transmission Line

The lead-in is usually connected directly to the 2' length of RG-8/U cable. For indoor installations the coaxial line may be routed thru the large knockout hole in the top of the cabinet. For weather exposed outdoor installation it is recommended that the lead-in be brought in thru an aperature at the bottom of the cabinet to prevent water leakage into the unit.

Refer to the instructions included with the antenna for particular antenna and transmission line installation details.

(2) Ground Connection

Connect terminal 5, bottom row, of the remote control chassis terminal board to a good external ground.

(3) Remote Control Unit Connections

(a) Two Wire Control Line

Connect the two wire 500/600 ohm control line from the remote control console to terminals #7 and #8 located in the bottom row of the right hand terminal board on the remote control chassis as viewed from the rear of the cabinet. Polarity of the control line must be observed. The control line must be connected so that terminal 8 is positive with respect to terminal 7 when the push-to-talk circuit is energized from the console. This control line should be shielded, the shield extending from where the line parallels the power and ground leads to within a short distance of the line input terminals. The shielding should be bonded and grounded to the transmitter frame (Terminal #5, bottom row, of the remote control chassis right hand terminal board).

(b) Four-Wire Control Line Connections

When a four-wire control line is used there are several special considerations to be observed, as follows:

First, some type of audio-dc line separation device must be used at the remote control consolette. The MOTOROLA P-8265 AF-DC Line Kit is designed for this application. When this kit is used, connect the 500/600 ohm line terminals of the consolette to terminals #1 and #2 of the line kit terminal board. Then connect the dc control line to terminals #3 and #4 of the line kit and connect the audio line to terminals #5 and #6 of the line kit. This provides the separation of audio and dc control functions into separate two-wire lines.

Second, refer to the JUMPER TABLE on the applicable remote control chassis schematic diagram in the REMOTE CONTROL section of this manual for necessary 4-WIRE REMOTE CONTROL jumper connections.

Third, connect the incoming audio line to terminals #7 and #8, bottom row, and the dc control line to terminals #1 and #2, bottom row, of the remote control chassis right-hand terminal board. DC control line polarity MUST BE OBSERVED. Check for polarity with the console push-to-talk circuit energized. Connect the positive line to terminal #2, bottom row; connect the negative line to terminal #1 bottom row (ground). Note that the consolette must be free of any EARTH GROUND. The af line should be shielded when running close to ground leads. The line shield should be run close to the terminals for the line, bonded and grounded to the transmitter frame. (Terminal 5 bottom row of the remote control chassis right hand terminal board.)

(4) Power Connection

NOTE

It is recommended that all other connections to the equipment be completed before connecting the power line to the equipment.

***NOTE* (Cont'd)**

Connect a 117 v ac single phase power line to the entrance fuse block located at the rear of the indoor upright or weatherproof cabinet on the Spare Fuse and Outlet Panel.

To avoid turning off the equipment inadvertently, an on-off switch is purposely omitted from indoor upright and weatherproof models. Therefore, do not connect the power source until the equipment is to be placed in operation unless a wall switch has been installed between the power source and the equipment. It is recommended that an automatic circuit breaker be installed between the power source and the equipment.

4. PRE-OPERATIONAL CHECKS AND ADJUSTMENTS

a. Initial Check

(1) When a transmitter is initially installed, a suitable procedure shall be employed to ascertain that the transmitter carrier is on the assigned frequency.

(2) The maximum transmitter modulation deviation for standard channel spacing operation is ±15 kc.

b. Metering Facilities

Metering receptacles have been provided on the transmitter and receiver chassis to facilitate metering with one of the MOTOROLA Portable Test Sets (P-8500 Series, P-8501 Series or TU546 Series) or with a multimeter AN/PSM-4 or AN/USM-34 or equivalent. The receptacle sockets have been identified for ease in locating corresponding test points. Refer to the metering tables on the Receiver and Transmitter Alignment Procedure Charts for complete metering information.

5. PRE-OPERATIONAL SYSTEM ADJUSTMENTS

Connect the antenna to be used to the station unit. Load the transmitter with the antenna connected, follow the procedure outlined in the TRANSMITTER section of this manual.

a. Squelch Adjustments

Place the SPEAKER switch on the audio panel in the "on" position. Turn the VOLUME control on the receiver chassis fully clockwise. With no signal being received, turn the SQUELCH control on the remote control chassis from the fully counterclockwise position slowly in the clockwise direction until the speaker is just squelched. Do not advance the control beyond this point or weak signals will be cut out.

b. Volume Adjustments

For this adjustment, the transmitter radiating a signal should be deviating fully (±15 kc). Then, connect a db meter or ac voltmeter across terminals 7 and 8 in the right bottom terminal board of the remote control chassis. Adjust the VOLUME control on the receiver chassis to obtain zero db or a reading of 1.73 volts on the ac voltmeter with a signal being received.

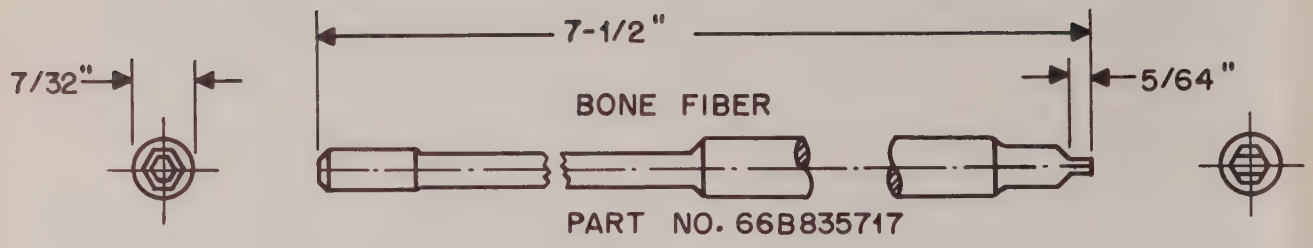
6. OPERATIONAL PROCEDURE

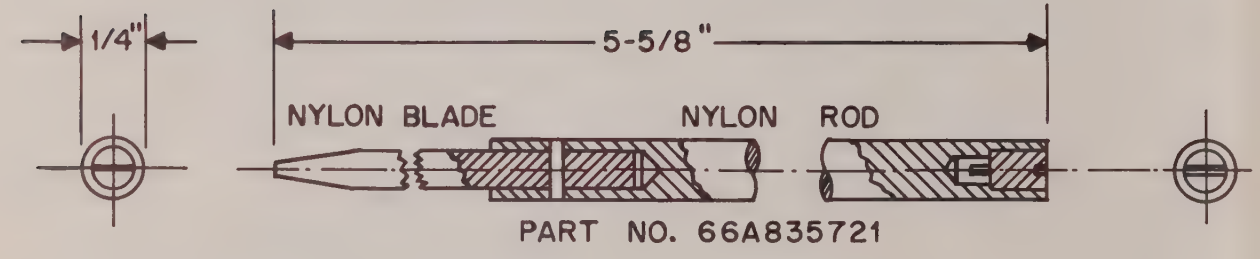
a. Local Test Control

Microphone M-90/U (MOTOROLA Model TU351A-N) may be connected to the MIC receptacle on the power supply chassis to turn "on" and modulate the transmitter.

b. Remote Control

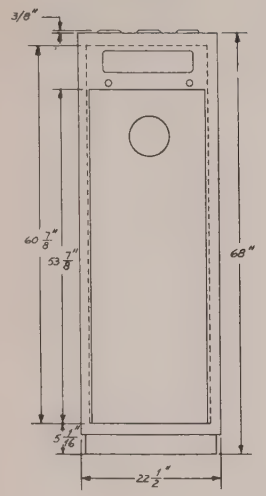
The base station radio is designed for remote control from the Control, Radio Set C-2351/FRC (MOTOROLA Model TA270-N Remote Control Console) via a 2-wire or 4-wire control line. Refer to the console instructions for connections and operating procedure.



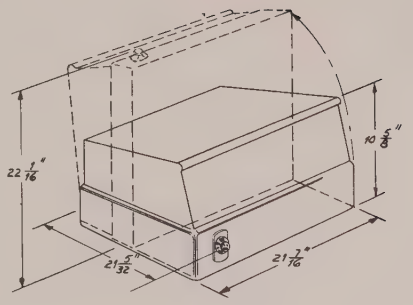


KIT NO.	TOOLS SUPPLIED
TK578	66B835717 AND 66A835721
K-9322	66A835721 ONLY

INDOOR UPRIGHT CABINET
FRONT VIEW

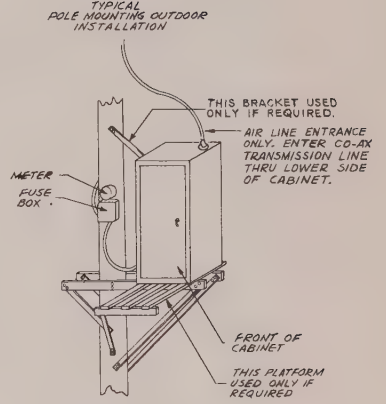


SINGLE RECEIVER
INDOOR DESK TOP CABINET

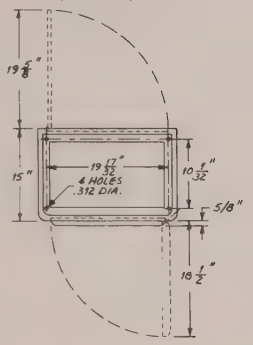


WEATHERPROOF CABINET
FRONT VIEW

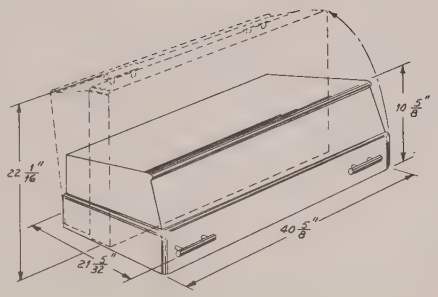
TYPICAL
POLE MOUNTING OUTDOOR
INSTALLATION


THIS BRACKET USED ONLY IF REQUIRED.
AIR LINE ENTRANCE ONLY. ENTER CO-AX TRANSMISSION LINE THRU LOWER SIDE OF CABINET.
METER
FUSE BOX
FRONT OF CABINET
THIS PLATFORM USED ONLY IF REQUIRED

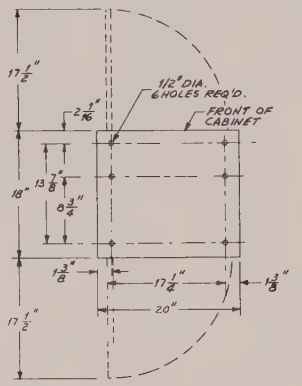
BOTTOM VIEW



TWO-RECEIVER
INDOOR DESK TOP CABINET

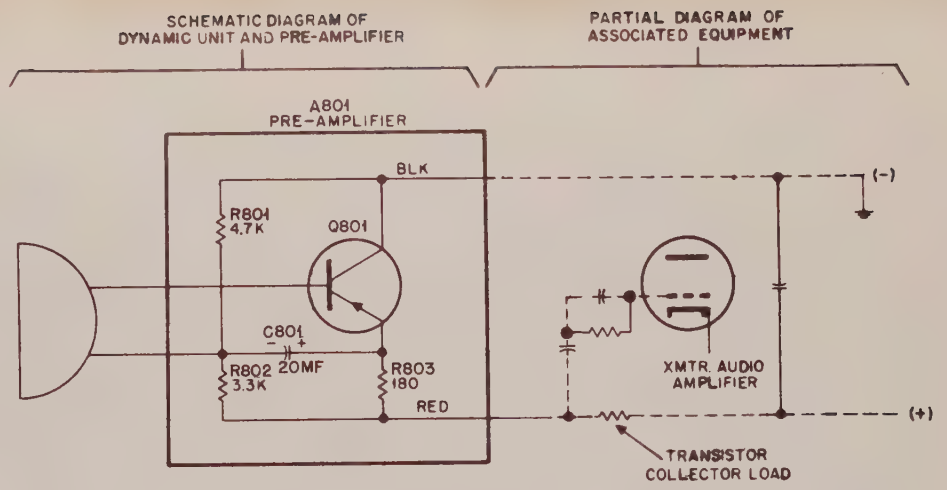


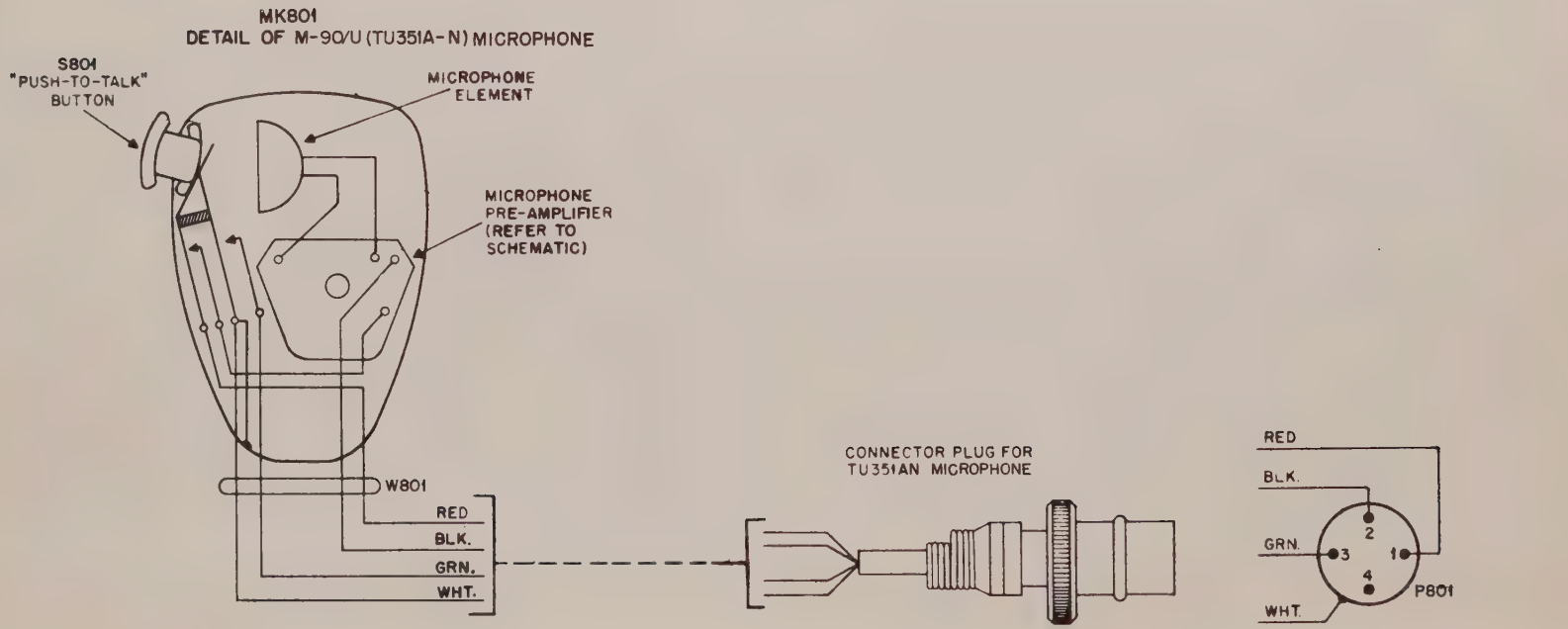
BOTTOM VIEW



Cabinet Dimensional Detail
Motorola No. 63D830785-A
3/6/59-UM

Microphone Schematic Diagram
Motorola No. 63C856108-A
3/6/59-UM

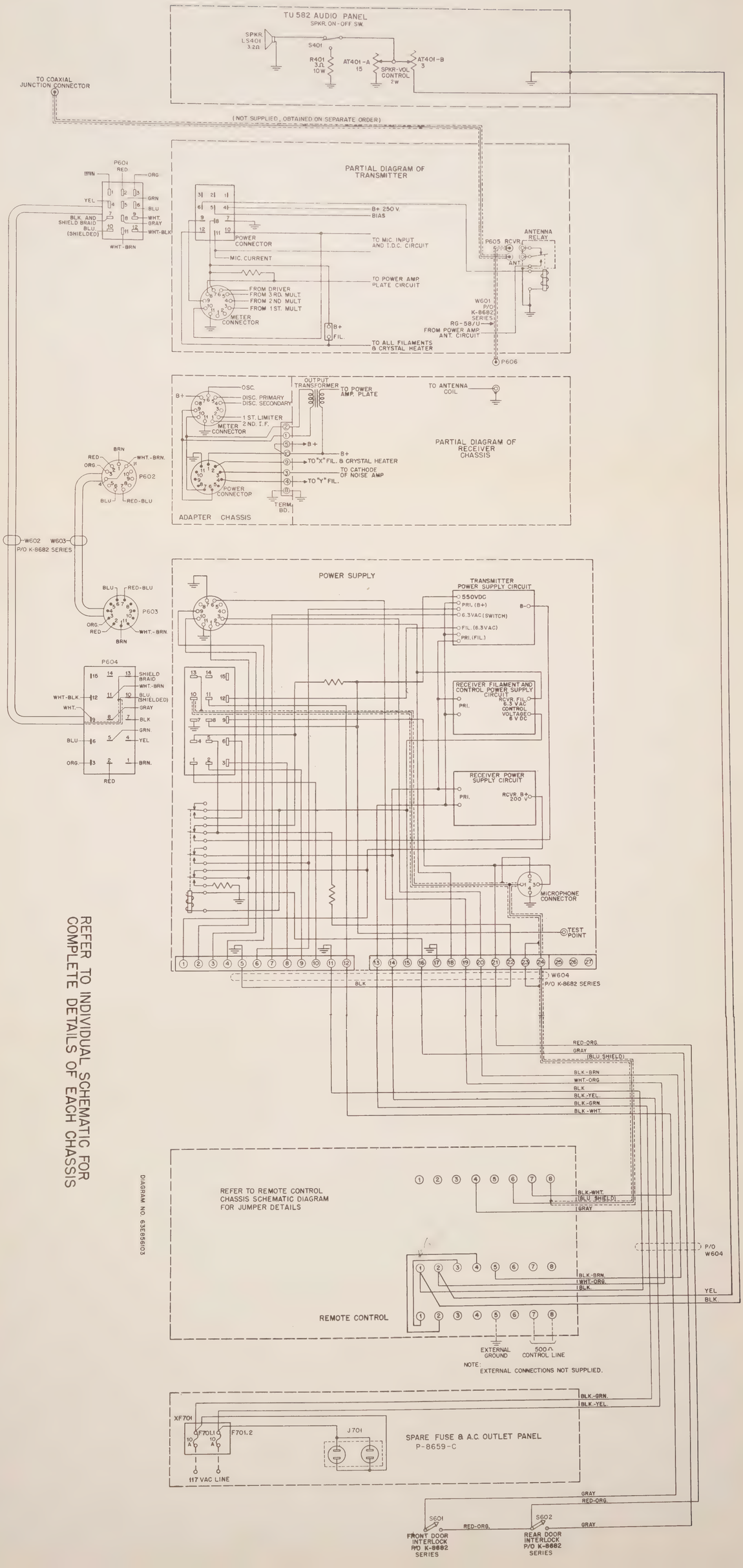




MODEL TABLE

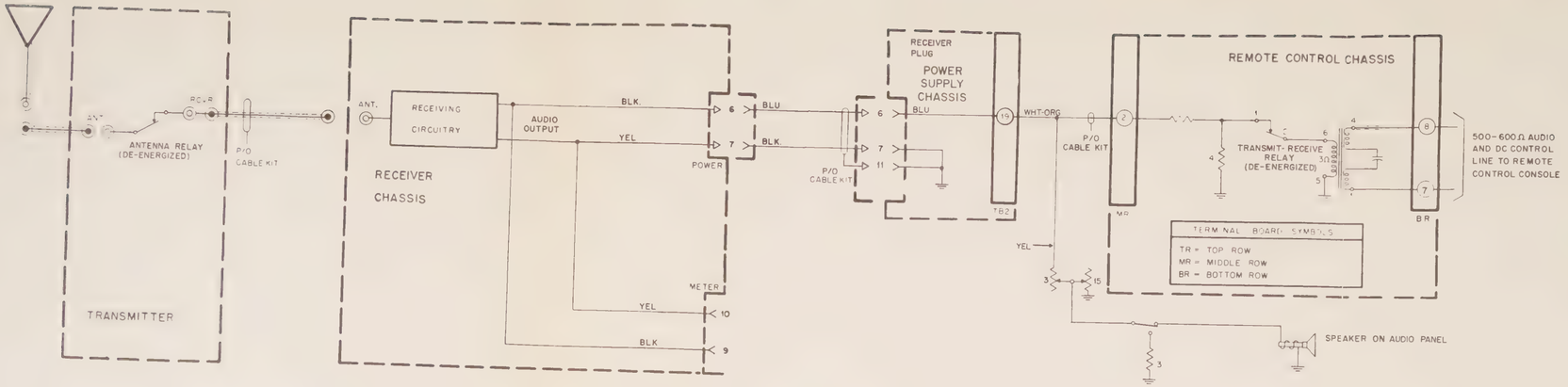
MODEL	APPLICATION
M-90/U(TU351A-N)	BASE STATION TEST

DIAGRAM NO. 63C856108



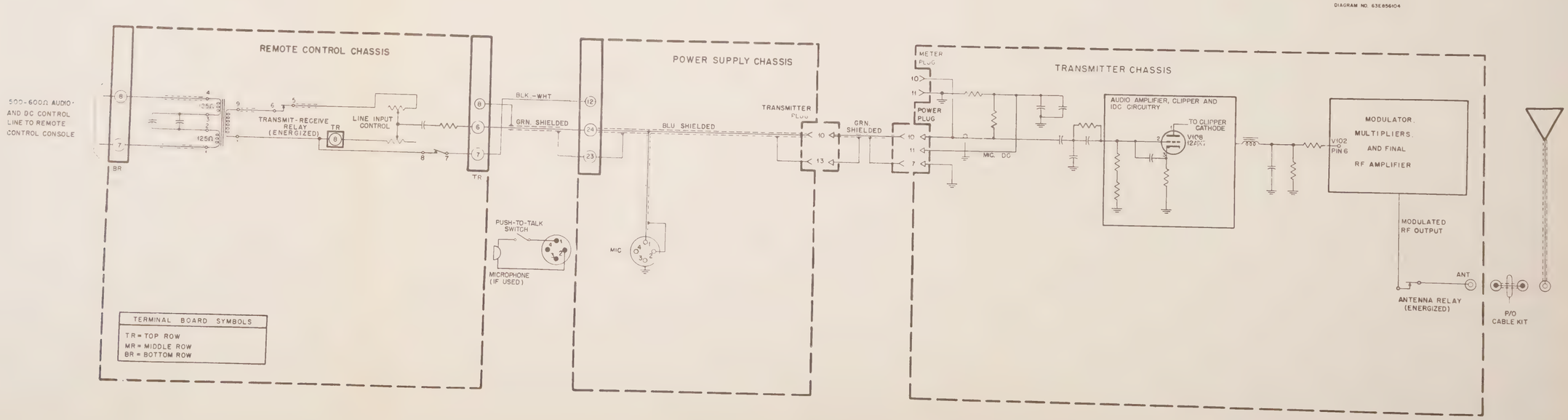
Intercabling Diagram
Motorola No. 63E856103-A
3/6/59-UM

RECEIVED AUDIO CIRCUIT

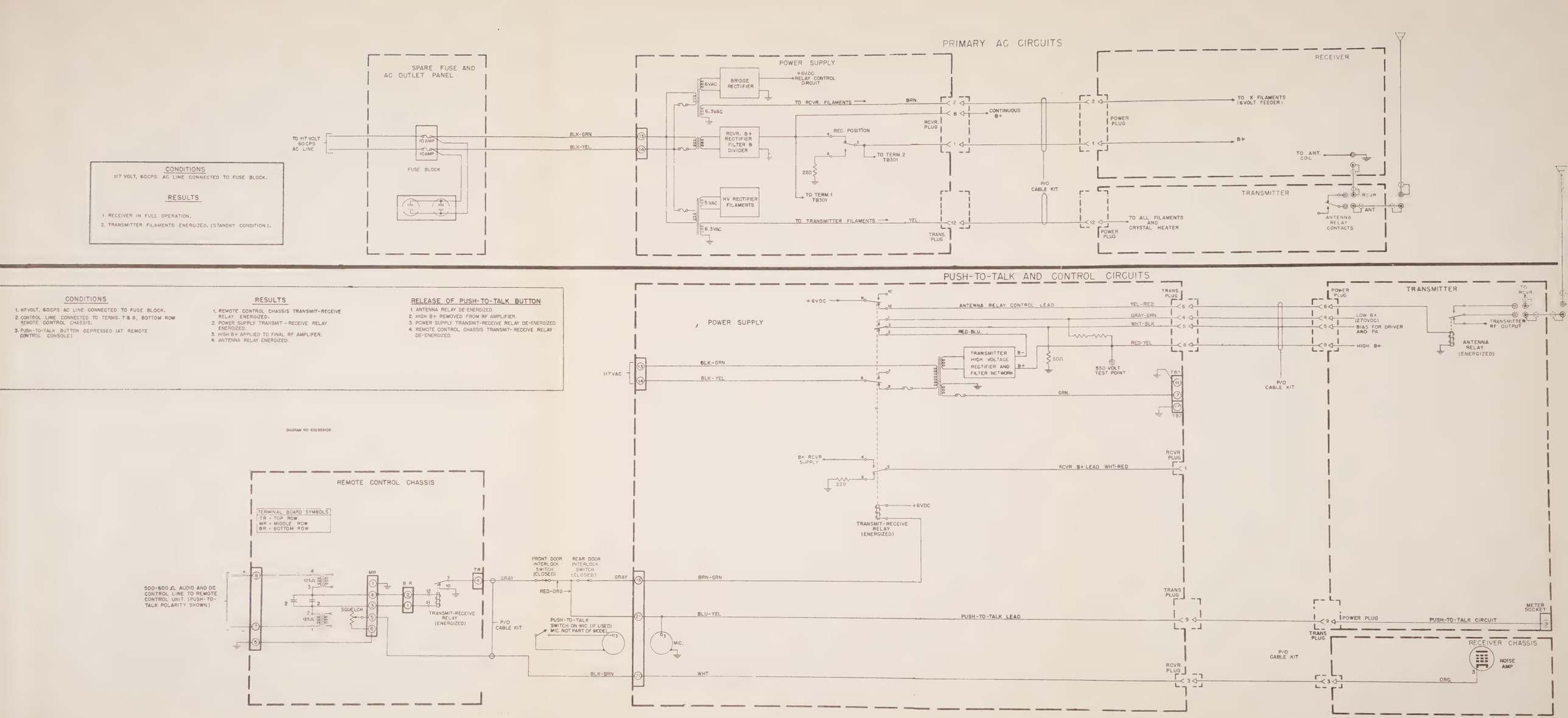


TRANSMITTED AUDIO CIRCUIT

DIAGRAM NO. 63E856104

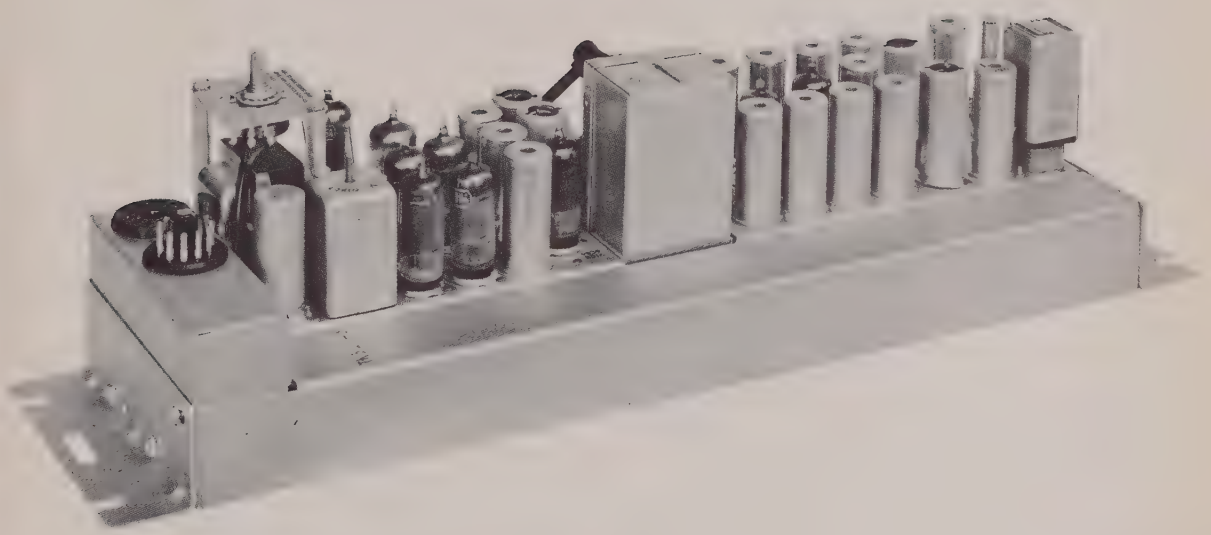


Audio Circuit Diagram
Motorola No. 63E856104-O



A-C & Control Circuit Diagram
Motorola No. 63E856105-O
3/6/59-UM

CE1008-A



TA140BWQ-N RECEIVER

1. DESCRIPTION

a. Design

The MOTOROLA TA140BWQ-N SENSICON "G" Receiver is a dual conversion, crystal controlled, superheterodyne FM receiver. It is designed for operation on a specific frequency within the 132-152 mc band. Reception of FM signals is provided by two limiter stages, an inductive type discriminator and two audio amplifiers. Amplification is achieved by one r-f amplifier, one 1st i-f amplifier and three stages of 2nd i-f amplification. Undesirable noise, at the speaker, is eliminated by means of an adjustable sensitivity squelch circuit.

b. Application

This receiver, employing a TU145A or TU540W "Permakay" Filter, is expressly applicable for normal adjacent channel operation; i.e.; -100 db signal attenuation at ±32 kc.

c. Stage Analysis

Stage-by-stage signal flow and operating frequencies are shown on the block diagram included in this section.

(1) R-f Stage

The first r-f tuned circuit provides the

GUARANTEED PERFORMANCE SPECIFICATIONS

MODEL	MOTOROLA Model TA140BWQ-N
FREQUENCY RANGE	132-152 mc
SENSITIVITY	Less than 0.50 microvolt for 20 db quieting; 50 ohms r-f input impedance
SELECTIVITY	-100 db at ±32 kc
MODULATION ACCEPTANCE	±15 kc
SPURIOUS RESPONSE	All spurious and image responses are attenuated 85 db or more
TEMPERATURE RANGE AND FREQUENCY STABILITY	Using an oven type crystal, the oscillator frequency is maintained to within .0005% of the center frequency (+25°C reference) over the ambient temperature range of -30°C to +60°C. Using an unheated crystal, the oscillator frequency is maintained to within .0025% of the center frequency (+25°C reference) over the ambient temperature range of -30° to +60°C.
SQUELCH	Noise compensated type; adjustable sensitivity; threshold sensitivity 0.18 microvolt. (U.S. Patent No. 2343115, other patents pending.)
AUDIO OUTPUT	1.5 watts to a 3.2 ohm speaker at 10% distortion
TUBE COMPLEMENT AND FUNCTION	6AK5 - RF Amp 6CB6 - Oscillator & Mult. 6AB4 - 1st Mixer 6BH6 - 1st IF 6679/12AT7 - 2nd Mixer & Osc. 6CB6 - 2nd IF - 1 6CB6 - 2nd IF - 2 6CB6 - 2nd IF - 3 6BH6 - 1st Limiter 6BJ6 - 2nd Limiter 6AL5 - Discriminator 6BH6 - Noise Amplifier 6C4 - Noise Rectifier 6679/12AT7 - Audio & Squelch Amp. 6AQ5 - Audio Output
NUMBER OF TUNED CIRCUITS	Total: 30 permeability tuned circuits Antenna, R-f amplifier, and oscillator-multiplier stages include 7 tuned circuits I-f amplifier stages include 11 tuned circuits I-f filter includes remainder of tuned circuits
FILTER TYPE	TU145A or TU540W "Permakay" I-F Filter contains 12 plastic-cast tuned circuits
METERING	Military multimeter AN/PSM-4, AN/USM-34 or a MOTOROLA Portable Test Set can be used to measure all circuits essential to tuning and checking.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

proper impedance match for the signal between the antenna and the grid of the r-f amplifier. The output of the amplifier is fed to the following mixer stage.

(2) First Oscillator and Mixer

In base station applications the first local oscillator frequency is controlled by a military type CR-32/U (MOTOROLA type RM crystal). The crystal is housed in a thermostatically-controlled heating oven for maximum stability over a wide temperature range.

The control crystal frequency is between 30 mc and 35 mc depending upon the exact carrier frequency assigned to the receiver. Two tuned circuits in the plate of the oscillator, tuned to four times the crystal frequency couple the injection voltage to the mixer cathode. The injection frequency and the incoming r-f carrier frequency are heterodyned in the mixer to produce the first intermediate frequency. This is the difference between these two signal frequencies.

(3) First I-F and Second Mixer

The signals are amplified in the first i-f amplifier stage and applied to the second mixer together with an injection frequency from the second local oscillator. The second local oscillator frequency is 12.455 mc. In the second mixer the difference frequency is used as the output.

(4) Second I-F

A "Permakay" Filter is used in the second i-f before the amplification stages. This filter is permanently sealed in polyesterstyrene and is unconditionally guaranteed for the life of the receiver provided the seal is unbroken and the housing is not tampered with. This filter is the major factor in determining the bandwidth of the receiver. It greatly attenuates signals outside the pre-determined pass-band. Signals leaving the filter are amplified by three stages of second i-f amplification and applied to the limiters.

(5) Limiters, Discriminator and Audio Stages

The two limiter stages clip the tops and bottoms of the incoming signals, thereby virtually eliminating the noise which characteristically "rides" the signals in the form of amplitude modulation. These stages are largely responsible for the "quieting" effect inherent in the FM communications receiver when it picks up an on-frequency signal. The limiter output is sent to the discriminator, which translates frequency deviations into corresponding amplitude variations, thereby detecting the audio modulation. Two stages of audio amplification provide a one and one-half watt audio output to a three-ohm load.

(6) Noise-Actuated Squelch Circuit

The noise-actuated squelch circuit consists of a noise amplifier, a noise rectifier, a d-c amplifier and associated circuit components. The discriminator output is applied to the input of the noise amplifier, V12. The input r-c network greatly attenuates the low-frequency components but passes frequencies above 3000 cps. These random frequencies are applied as a signal to the grid of V12 and amplified like other types of signal inputs. In the cathode of the noise amplifier the variable SQUELCH control varies the gain of the tube by adjusting its bias. The setting of this control is covered in the following paragraph.

The output of the noise amplifier drives the noise rectifier, V13. The rectified noise signal appears as positive voltage across the load resistor. This positive voltage is added to a steady negative bias taken from the second limiter stage. The resultant of these two voltages is applied to the grid of the d-c amplifier tube. In the no-signal condition, i.e., noise alone, the resultant voltage is zero or somewhat positive. The d-c amplifier conducts and cuts off the audio amplifier tube. This keeps the speaker silent when signals are not being received. When signals are received the noise is greatly reduced and the rectified noise output is not enough to overcome the steady negative bias on the grid of the d-c amplifier. In this condition the d-c amplifier is cut off and the audio amplifier operates normally, passing on the received audio signals.

(7) Squelch Control Setting

The SQUELCH control limits the gain of the noise amplifier tube. In practice, this control is adjusted for a "threshold" setting. This is the point where the rectified noise voltage will bias the grid of the d-c amplifier so that the audio amplifier is just barely cutoff. Then, when a weak signal is received a slight reduction in noise will cut off the d-c amplifier and allow the audio

amplifier to conduct. Carrier signals are "rated" by the amount of receiver quieting which they produce. The SQUELCH control should be adjusted so that a signal which produces about 4 or 5 db quieting will open the squelch circuit.

2. METERING

Either multimeter AN/PSM-4 or AN/USM-34 may be used for metering in lieu of a Motorola portable test set, utilizing the lowest dc voltage scale for most measurements. The chassis metering receptacles for the receiver and the transmitter units have been referenced to correspond to the metering positions of the portable test sets. The meter should be connected between the pin position to be read and pin 11 of the metering receptacle. (Pin 11 is ground.)

CAUTION

Position 7 of the metering receptacle provides measurement of the receiver B+ voltage. When testing with above listed multimeters, use a dc scale of at least 250 volts.

3. ALIGNMENT PROCEDURE

Two receiver alignment procedures are outlined in this section. The first is a complete bench alignment procedure chart. This is followed by a simplified alignment procedure chart. DO NOT use the simplified procedure until you have becomes familiar with the complete bench alignment procedure.

Before attempting alignment of the receiver the following preliminary considerations should be noted:

a. Frequency Calculations

The control crystal frequency can be calculated from the following formula:

$$f_{01} = \frac{f_c - 12 \text{ mc}}{4}$$

Where:

f_{01} = control crystal frequency (mc)

f_c = carrier frequency (mc)

12 mc = first i-f (same for all units)

The i-f crystal frequency is fixed at 12.455 kc for all units. This provides a second i-f of 455 kc when mixed with the first i-f. These relationships are shown in the following formula:

$$f_{02} = f_1 + f_2$$

Where:

f_{02} = i-f crystal control frequency (kc)

f_1 = first i-f (12 mc)

f_2 = second i-f (455 kc)

b. Frequency Checks

(1) Turn the equipment on and allow a 5 minute warm-up period.

(2) Connect a MOTOROLA Portable Test Set to the METER receptacle on the chassis, or connect the multimeter between the receptacle reference points and ground for the following readings. The oscillator trimmer capacitor, C35, should be set at a position 20° from minimum capacitance (see Comprehensive Alignment Detail C).

(3) Radiate a signal from a transmitter which the receiver is normally intended to receive.

NOTE

Be certain that the remote transmitter is operating on the correct carrier frequency before readjusting the receiver.

(4) Check the discriminator balance against this frequency by placing the meter switch in position -4 or +4. If a multimeter is used in place of the portable test set this reading is accomplished by shifting the meter function switch between direct and reverse dc voltage positions with test leads connected to pins 11 and 4. If the reading is within ±0.020 volts of zero, receiver alignment can be considered satisfactory.

If not within ±0.020 volts of zero, adjust the oscillator trimmer (C35) for a zero meter reading on position +4 or -4. The oscillator coil tuning adjustment is for small frequency corrections and is to be adjusted only after the oscillator has been aligned according to the procedure outlined in the comprehensive bench alignment procedure.

(5) Tune the antenna coil (L1) for maximum meter reading in position 1 with a reasonably weak received signal.

c. Sensitivity Check

Quieting signal is that input signal necessary to reduce the output noise, at speaker, 20 db. Quieting measurements should be made in a well shielded location in the absence of extraneous noises.

This measurement is important in that it indicates in one measurement that the unit is working normally.

The actual measurement is made by observing the noise voltage at the speaker without any carrier at the antenna. Sufficient carrier is then introduced at the antenna to reduce the output voltage to 1/10 its former value.

To measure the quieting signal accurately, a Measurements Corporation Model 80 Signal Generator or equivalent, and a multimeter or MOTOROLA Portable Test Set are required. Employment of a VTVM (AN/USM-34 or equivalent) or db output meter (Audio Output Meter ME-6( )/U or equivalent) suitable for accurate measurement of receiver audio output, is also recommended.

(1) Turn the signal generator "on" and stabilize by a "warm-up" period of 1-1/2 to 2 hours.

(2) Connect the meter plug from the Portable Test Set to the meter receptacle on the chassis.

(3) Place the REC-XMTR-0-50 ua switch in the REC position and the GRID CURRENT-METER-FIELD STRENGTH switch in the METER position on the Test Set.

(4) Connect a signal generator, adjusted to the desired carrier frequency to the antenna input connector using the coaxial lead and 6 db pad. The exact carrier frequency will be indicated by a zero reading on the test set with the meter switch in position +4 or -4, or a zero reading in either the direct or reverse voltage setting of the multimeter function switch when the multimeter is connected to pins 11 and 4 of the metering socket.

(5) Connect the output meter across the voice coil leads (terminals 1 and 2 on the terminal board of the power supply or adapter chassis). Note: If an output meter is not available, the Test Set may be used to measure receiver output by placing the Test Set selector switch in position 8. (Test Set measurements are purely relative and will not constitute actual output level readings.)

(6) Turn the SQUELCH control fully counterclockwise (off).

(7) With no signal input to the receiver (signal generator ATTENUATOR control set for zero output) adjust the VOLUME control on the receiver chassis for 0.5 volts of noise output on the audio output meter. (Adjust for a reading of 10.0 if the test set is used for this measurement.)

(8) Adjust the output level of the signal generator until the receiver audio output is decreased 20 db (to 0.05 volts on the audio output meter) from the reading in step (7). Adjust for a reading of 1.0 if the test set is used for this measurement.

(9) Note the setting of the signal generator output control. This value (in microvolts) is the 20 db quieting sensitivity of the receiver.

4. STAGE MEASUREMENTS CHART

APPROX. MICROVOLT INPUT	INPUT TO	FREQ. IN MC.	MOTOROLA TEST SET SWITCH POS
Noise	Antenna	-	1
Noise	Antenna	-	2
Noise	Antenna	-	4
Noise	Antenna	-	5
Noise	Antenna	-	6
0.60 or less	Antenna	F_c	*DB Meter
2.0	Antenna	F_c	1
2.2	Pin 1 of V1	F_c	*DB Meter
12	1st RF	F_c	1
3.0	Pin 6 of V2	12.0	*DB Meter
20	1st Mixer	12.0	1
4.0	Pin 1 of V3	12.0	*DB Meter
100	1st IF	12.0	1
5000	Filter	.455	1
2000	Pin 1 of V6 2nd IF-1	.455	1
150,000	Pin 1 of V7 2nd IF-2	.455	1

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METER READING OR DB.	MULTIMETER CONNECTIONS TO METER SOCKET	AN/PSM-4 0-2 VOLT SCALE	AN/PSM-4 0-2.5 VOLT SCALE	AN/USM-34
-0.1 to -1	Neg to 1 Pos to 11	.0039 to .039	.0048 to .048	.14 to 1.4
-15 to -33	Neg to 2 Pos to 11	.59 to 1.3	.73 to 1.60	23.8 to 52.4
0 to ±1	Neg to 4** Pos to 11	0 to .039	0 to .048	0 to 1.35
-12 to -16	Neg to 5 Pos to 11	.47 to .63	.58 to .78	22.8 to 30.2
-12 to -40	Neg to 6 Pos to 11	.38 to 1.20	.42 to 1.40	1.43 to 4.75
20 db. (quieting)				
-4 —	Neg to 1 Pos to 11	.15	.19	5.40
20 db. (quieting) -4	Neg to 1 Pos to 11	.15	.19	5.40
20 db. (quieting) -4	Neg to 1 Pos to 11	.15	.19	5.40
20 db. (quieting) -4	Neg to 1 Pos to 11	.15	.19	5.40
-5	Neg to 1 Pos to 11	.19	.24	6.75
-5	Neg to 1 Pos to 11	.19	.24	6.75
-5	Neg to 1 Pos to 11	.19	.24	6.75

NOTE

nents Corporation Model 80 Signal Generator with
(Measurements Corporation Part No. 80-XH4) was
aking readings on V1, V2 and V3. A Model 65B
rator with a 30 ohm terminated output cable was used
all other readings except filter input reading. Signal
AN/URM-25 also provides the required signal fre-
ted above.

boratory Sensitivity Check on page 5 when making
ement

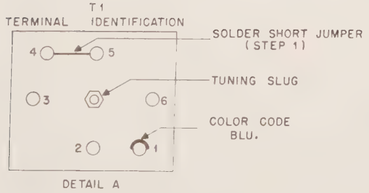
function switch to reverse polarity.

HOW TO SET UP THE P-8500 & P-8501 SERIES TEST SETS FOR DISCRIMINATOR AND 455 KC ALIGNMENT

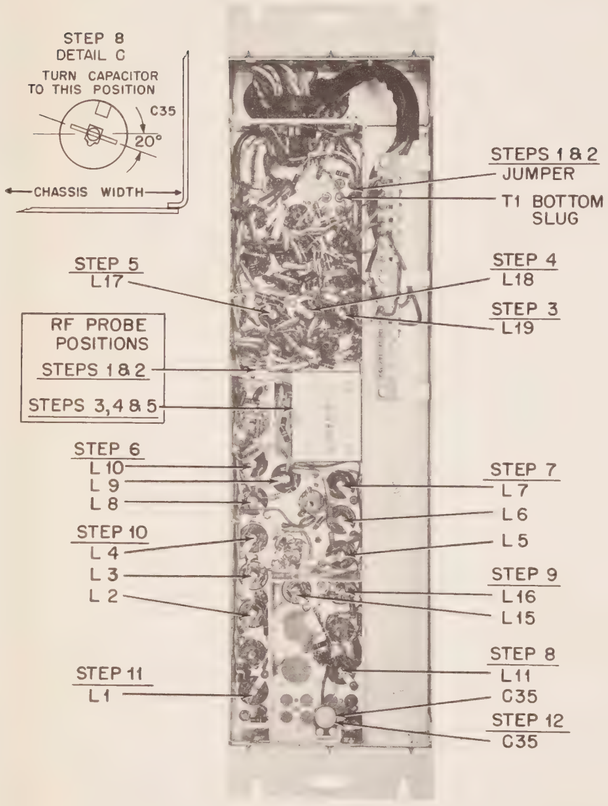
1. Set the REC. - XMTR. -0-50 UA switch to the REC. position.
2. Plug a 455 kc crystal into the two-pin crystal socket.
3. Set the GRID CURRENT-METER-FIELD STRENGTH selector switch to the GRID CURRENT position.
4. Set the ATTENUATOR control for maximum output (10).
5. Place the test set ON-OFF switch in the ON position. (Test set operates on internal battery. Conserve battery life by keeping switch OFF when set is not in use.)
6. Adjust the frequency control (ADJ) for a maximum meter reading.
7. Set the ON-OFF switch to the OFF position.
8. Set the GRID CURRENT-METER-FIELD STRENGTH switch to the METER position.
9. Plug the test set metering cable into the METER receptacle on the receiver chassis.
10. Connect one end of the test set extension cable to the RF OUTPUT jack on the test set. Connect the other end of the extension cable to the RF probe cable.

HOW TO SET UP THE TU546 SERIES TEST SETS FOR DISCRIMINATOR AND 455 KC ALIGNMENT

1. Set the function selector switch to the RCVR position.
2. Plug the 455 kc crystal into the 2-pin socket inside the test set.
3. Connect the 20-pin metering cable into the receptacle on the test set. Plug the other end (11-pin) into the metering socket on the receiver.
4. Connect one end of the test set r-f extension cable to the RF connector on the test set. Connect the other end of the extension cable to the r-f probe cable.



DETAIL A



STEP	STAGE, TEST CONDITIONS AND PROCEDURE
1	DISCRIMINATOR PRIMARY - Solder a short jumper across terminals 4 and 5 of the discriminator secondary coil (see DETAIL A, lower left). Set up the Portable Test Set as described in the left hand column. Place the test set selector switch in position 1 and apply d-c input to the test set. Move the rf ‡ probe around near pin 1, V6, until the meter reading is at least 15 ua. Secure the probe in its position and place the selector switch in position 5. Loosen the locknut of the T1 bottom slug adjustment screw, adjust the slug for maximum meter reading and tighten the locknut while holding the slug in the position of maximum meter reading. Unsolder the jumper.
2	DISCRIMINATOR SECONDARY - With the rf probe placed as in step 1 adjust the top slug of T1 for exactly zero meter reading with the selector switch on position +4 or -4 (on Model TU546 Test Set, place selector switch ON position 4).
3	455 KC IF COIL L19 - Place the rf probe near the input to the 455 kc i-f filter (see illustration. Couple the signal loosely so that an increase of signal strength will produce a linear increase in meter reading (switch in position 1 or 2). Secure the probe in position to keep the input at a constant level. Adjust L19 for a maximum meter reading with the switch in position 2.
4	455 KC IF COIL L18 - Couple the signal to the i-f filter so as to obtain a maximum reading of approximately 5 ua with the selector switch in position 1. Adjust L18 for a maximum reading.
5	455 KC IF COIL L17 - Use the same conditions as in step 4. Adjust L17 for a maximum meter reading. Place the Test Set ON-OFF switch in the OFF position and remove the rf probe.
6	12 MC IF COILS L10, L9 and L8 - Set up the Model 80 Signal Generator (or equivalent) as described at the left. After adjusting the signal generator set the test set selector switch to position 1 or 2 and couple the generator output to the grid (pin 1) of V3. The signal must be coupled loosely so that an increase of signal strength produces a linear increase in meter reading (position 1 or 2). Adjust L10 for a maximum meter reading with the switch in position 1 or 2 - note that two peaks are present within the coil tuning range. The peak found when the slug is nearest the top of the coil (as viewed from bottom of chassis) is the proper alignment peak. Adjust L9 and L8 for a maximum meter reading (position 1 or 2).
7	12 MC IF COILS L7, L6 and L5 - Follow the same procedure as in step 6 except couple the signal to the grid (pin 6) of V2 and adjust L7, L6 and L5; no double peaks will be found.
8	FIRST OSCILLATOR COIL L11 - Uncouple the signal generator. Position the ceramic trimmer, C35, so that the screwdriver adjustment slot is 20° from parallel with the width of the receiver chassis (see detail "C"). Adjust coil L11 for a maximum meter reading with the selector switch in position 6.
9	OSC-MULT COILS L15 & L16 - The signal generator must be set for the exact carrier frequency to be received. To do this follow the procedure outlined below the illustration except select the carrier frequency instead of 12 mc and couple the signal to pin 6 of V2 instead of pin 7, V4. With the generator output coupled loosely to pin 6, V2 adjust L16 and L15 for maximum meter reading (position 1 or 2).
10	RF COILS L4, L3 and L2 - Keep the signal generator set for the carrier frequency as in step 9. Couple the signal loosely to the grid (pin 1) of V1. Adjust L4, L3 and L2 for maximum reading (position 1 or 2).
11	ANTENNA COIL L1 - Connect the signal generator output to the antenna receptacle on the receiver chassis. Use a 6 db, 50 ohm, attenuation pad between the generator and the receiver input. Adjust L1 for maximum reading.
12	FREQUENCY CHECK - Transmit the carrier frequency from the transmitter which this receiver is normally intended to receive. A zero meter reading indicates that the receiver is on frequency. Adjust trimmer C35 to obtain a zero meter reading. Check the final setting by rotating C35 back and forth while observing the meter. The reading should go above and below the zero point as the trimmer is rotated. Set C35 for exactly zero meter reading.

‡If a portable test set is not available, use an accurate

GNMENT EQUENCY	ADJUSTMENT	PORTABLE TEST SET SWITCH POSITION	EQUIVALENT LEAD & PIN POSITIONS (SEE TABLE ON LEFT)	METER READING
55 kc rp tuning	T1 bottom slug	5	Neg. to 5 Pos. to 11	Maximum
55 kc rp tuning	T1 top slug	+4 or -4	Pos. or Neg. to 4 Neg. or Pos. to 11	Zero
55 kc rp tuning	L19	2	Neg. to 2 Pos. to 11	Maximum
55 kc rp tuning	L18	1	Neg. to 1 Pos. to 11	Maximum
55 kc rp tuning	L17	1	Neg. to 1 Pos. to 11	Maximum
2 mc rp tuning	L10, L9 and L8	1 or 2	Neg. to 1 or 2 Pos. to 11	Maximum
2 mc rp tuning	L7, L6 and L5	1 or 2	Neg. to 1 or 2 Pos. to 11	Maximum
eceiver rystal quency, rp tuning	L11	6	Neg. to 6 Pos. to 11	Maximum
Carrier equency rp tuning	L16 and L15	1 or 2	Neg. to 1 or 2 Pos. to 11	Maximum
arrier equency rp tuning	L4, L3 and L2	1 or 2	Neg. to 1 or 2 Pos. to 11	Maximum
arrier equency rp tuning	L1	1 or 2	Neg. to 1 or 2 Pos. to 11	Maximum
arrier equency rp tuning	C35	+4 or -4	Pos. or Neg. to 4 Neg. or Pos. to 11	Zero

signal input source.

TEST SET AND METER TABLE

Testing Equipment	2nd IF (#3) Grid	Equivalent Metering Positions			
		1st Lim. Grid	Discr. Output	Discr. Input	1st Osc. Grid
P-8500 & P-8501 Series Test Sets:	1	2	+4 & -4	5	6
TU546 Series Test Sets:	1	2	4	5	6
Multimeter (leads and metering pin):	Neg. to 1 Pos. to 11	Neg. to 2 Pos. to 11	Pos. or Neg. to 4 Neg. or Pos. to 11	Neg. to 5 Pos. to 11	Neg. to 6 Pos. to 11

HOW TO SET UP THE SIGNAL GENERATOR*
FOR 12 MC IF ALIGNMENT

1. Couple the signal generator output loosely to the grid (pin 7) of V4. Couple just enough input to give a small meter reading.

2. Set the test set selector switch to position +4 or -4. Set the ON-OFF switch to the ON position.

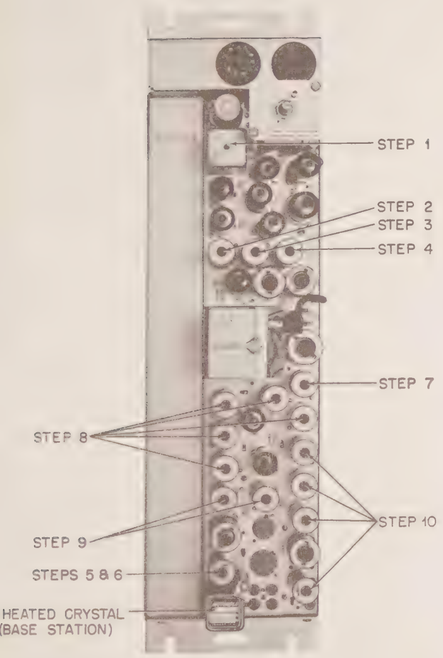
3. Set the signal generator frequency for approximately 12 mc.

4. Locate the exact 12 mc point by rotating the generator dial back and forth around the 12 mc setting until you obtain a meter reading of exactly zero (position 4). The meter reading should go above and below zero as the dial is rotated. Leave the generator set for zero meter reading. Make sure the signal remains constant throughout the alignment (generator may drift).

* Use a Measurements Corp. Model 80, or equivalent.

SIMPLIFIED ALIGNMENT PROCEDURE

After the serviceman becomes familiar with the alignment of this unit he may use this simplified procedure as an alignment. He should not attempt to use the chart until he has followed the comprehensive alignment procedure described in this section.



SEQUENCE	SWITCH POSITION	TEST LEAD POS. FOR MULTIMETER	STAGE AND TEST CONDITION	ALIGN. FREQ.	ADJUSTMENT	METER READING
Step 1	±4	Neg. or Pos. to 4 Pos. or Neg. to 11	DISCRIMINATOR SECONDARY COIL: See NOTE 1; place rf probe near pin 1 of V6 (rf probe to remain in this position for steps 1 thru 4).	455 kc sharp tuning	T1 (top slug)	Zero
Step 2	2	Neg. to 2 Pos. to 11	2nd IF - 3 COIL: Reduce generator output for reading of less than saturation.	455 kc sharp tuning	L19	Maximum
Step 3	1	Neg. to 1 Pos. to 11	2nd IF - 2 COIL	455 kc broad tuning	L18	Maximum
Step 4	1	Neg. to 1 Pos. to 11	2nd IF - 1 COIL	455 kc sharp tuning	L17	Maximum
Step 5	6	Neg. to 6 Pos. to 11	1st OSCILLATOR COIL: Disconnect generator before adjustment.	Rcvr. crystal freq. sharp tuning	L11	Maximum
Step 6	±4	Neg. or Pos. to 4 Pos. or Neg. to 11	1st OSCILLATOR COIL: Readjust coil with carrier signal being received from external transmitter. After adjustment, check meter for zero reading. If within ±1 ua of zero, alignment may be considered satisfactory. If more than ±1 ua from zero, refer to COMPLETE ALIGNMENT section of this manual.	Rcvr. crystal freq. sharp tuning	L11	Zero
Step 7	2	Neg. to 2 Pos. to 11	1st IF COIL: Note that two peaks are present within the coil tuning range. The peak found when the slug is nearest the top of the coil is the proper alignment peak.	12 mc sharp tuning	L10	Maximum
Step 8	2	Neg. to 2 Pos. to 11	1st IF and MIXER COILS: When using a P-8500 or P-8501 Series Test Set, plug XMTR control crystal into test set socket. Follow steps (2) through (7), Note 1. Test set meter should show some reading, indicating oscillator operation. Adjust test set frequency as in Note 2. Put rf probe in ANT connector. Set ATTENUATOR control for less than saturation.	12 mc sharp tuning	L9, L8, L7 L6 & L5	Maximum
Step 9	2	Neg. to 2 Pos. to 11	OSCILLATOR-MULTIPLIER COILS: Generator output and connections same as for step 8.	Crystal freq. (generator at carrier freq) sharp tuning	L16 & L15	Maximum
Step 10	2	Neg. to 2 Pos. to 11	RF COILS: Generator output and connections same as for step 8.	Carrier freq. sharp tuning	L4, L3 L2 & L1	Maximum

NOTE 1:

Preliminary Adjustments for Operating Test Set as Signal Generator

(1) Plug the 455 kc Alignment Crystal into the crystal socket of the Test Set.

(2) Place the REC - XMTR - 0-50 ua switch in the REC position.

(3) Set the GRID CURRENT-METER-FIELD STRENGTH switch in the GRID CURRENT position.

(4) Connect the rf Probe Cable to one end of the Extension Cable. Connect the opposite end of the Extension Cable to the rf OUTPUT receptacle on the Test Set.

(5) Place the Test Set ON-OFF switch in the ON position.

(6) Set the ATTENUATOR control for maximum output.

(7) Adjust the frequency ADJ control for a maximum reading on the Test Set Meter.

NOTE 2:

(1) Place the GRID CURRENT-METER-FIELD STRENGTH switch to the METER position and place the selector switch to positior +4 or -4.

(2) Adjust the Test Set oscillator frequency for a zero (±0.5 ua) reading by means of the ADJ control.

(3) Place the meter switch in position 2 and peak the test set OSC. TUNE control for maximum reading.

(4) Readjust the Test Set ADJ control for zero (±0.5 ua) reading in position +4 or -4.

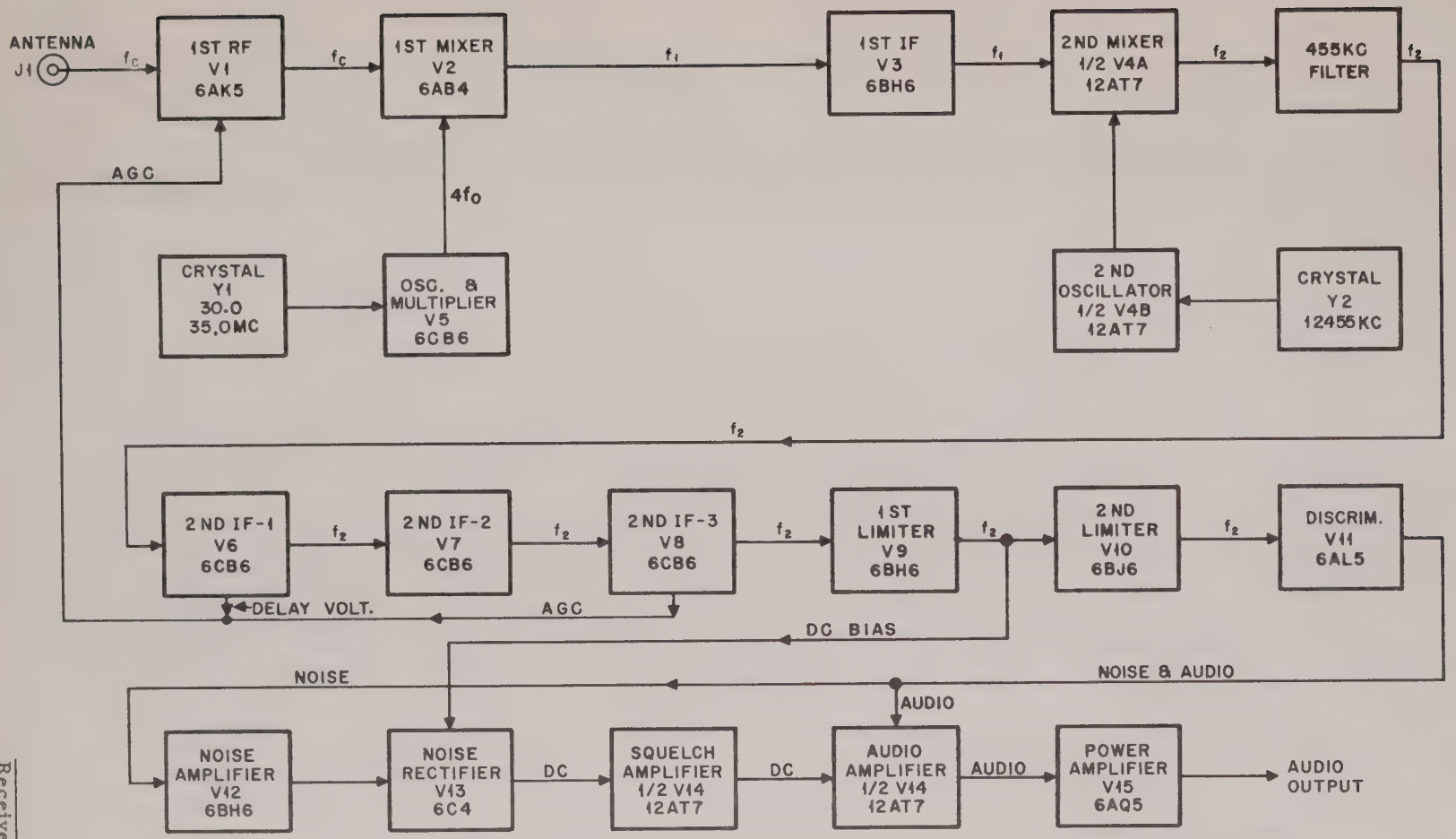


DIAGRAM NO. 63C856151

LEGEND:

f_c = CARRIER FREQUENCY

f_o = 1ST OSCILLATOR FREQUENCY

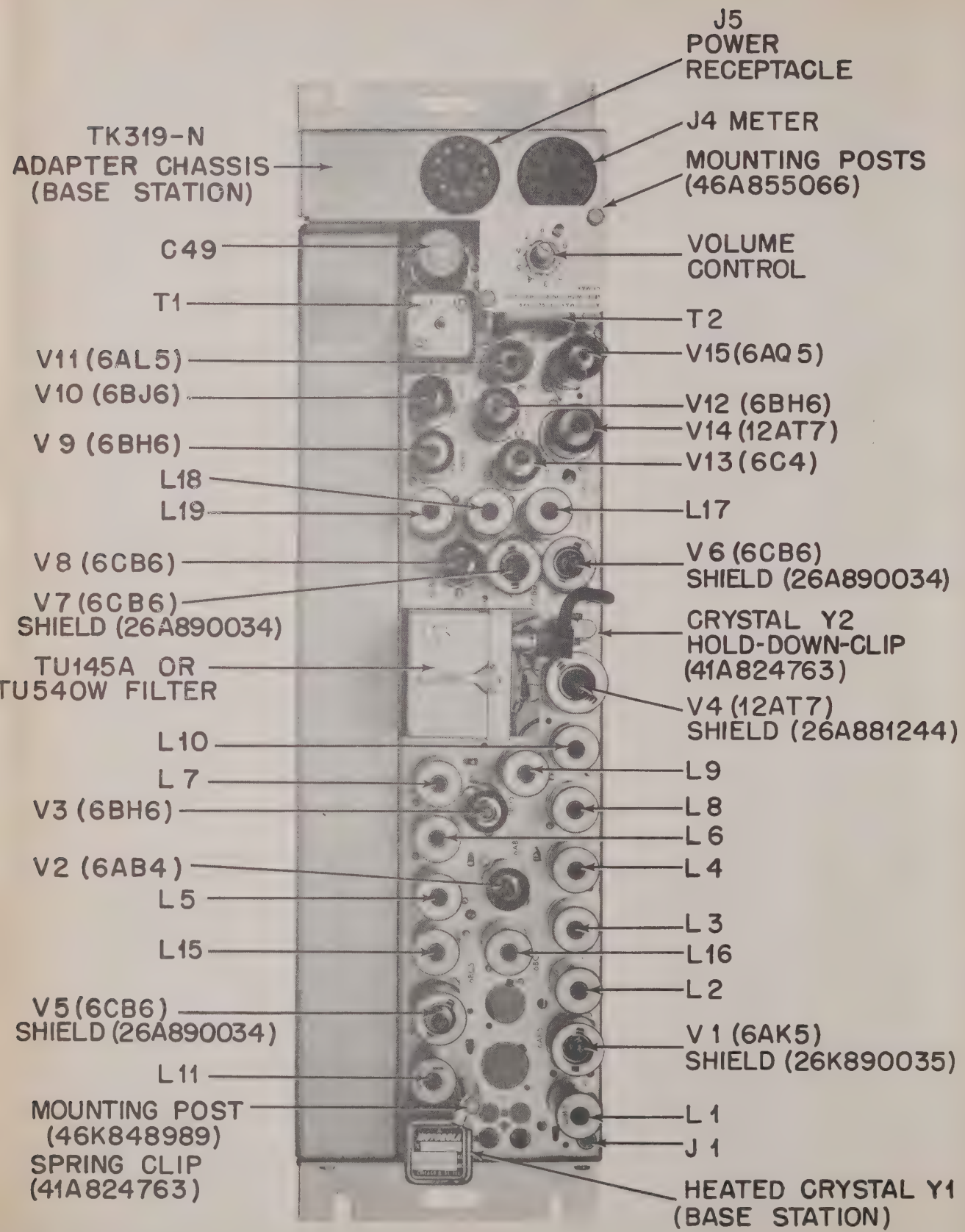
f_1 = 1ST INTERMEDIATE FREQUENCY = 12 MC.

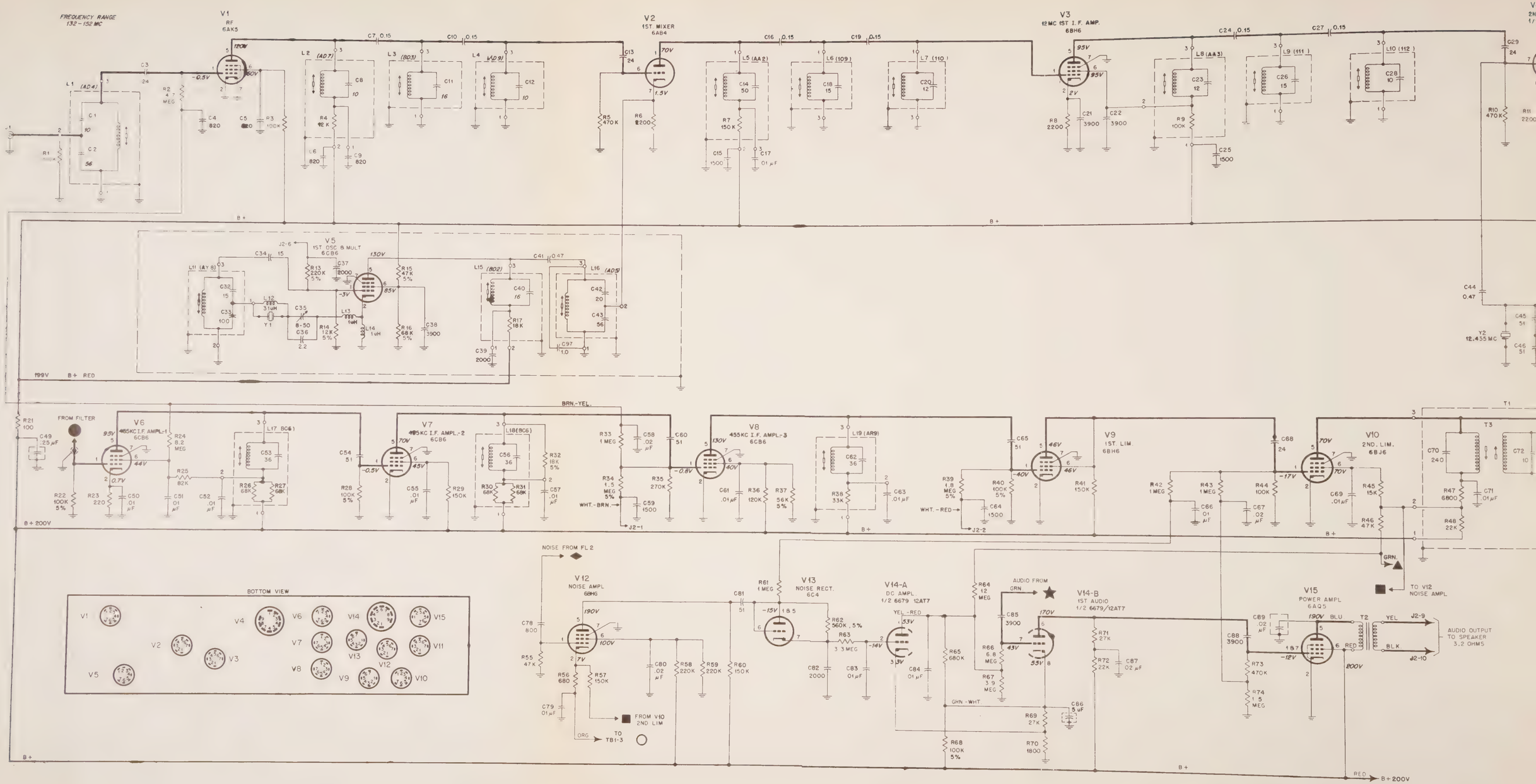
f_2 = 2ND INTERMEDIATE FREQUENCY = 455 KC.

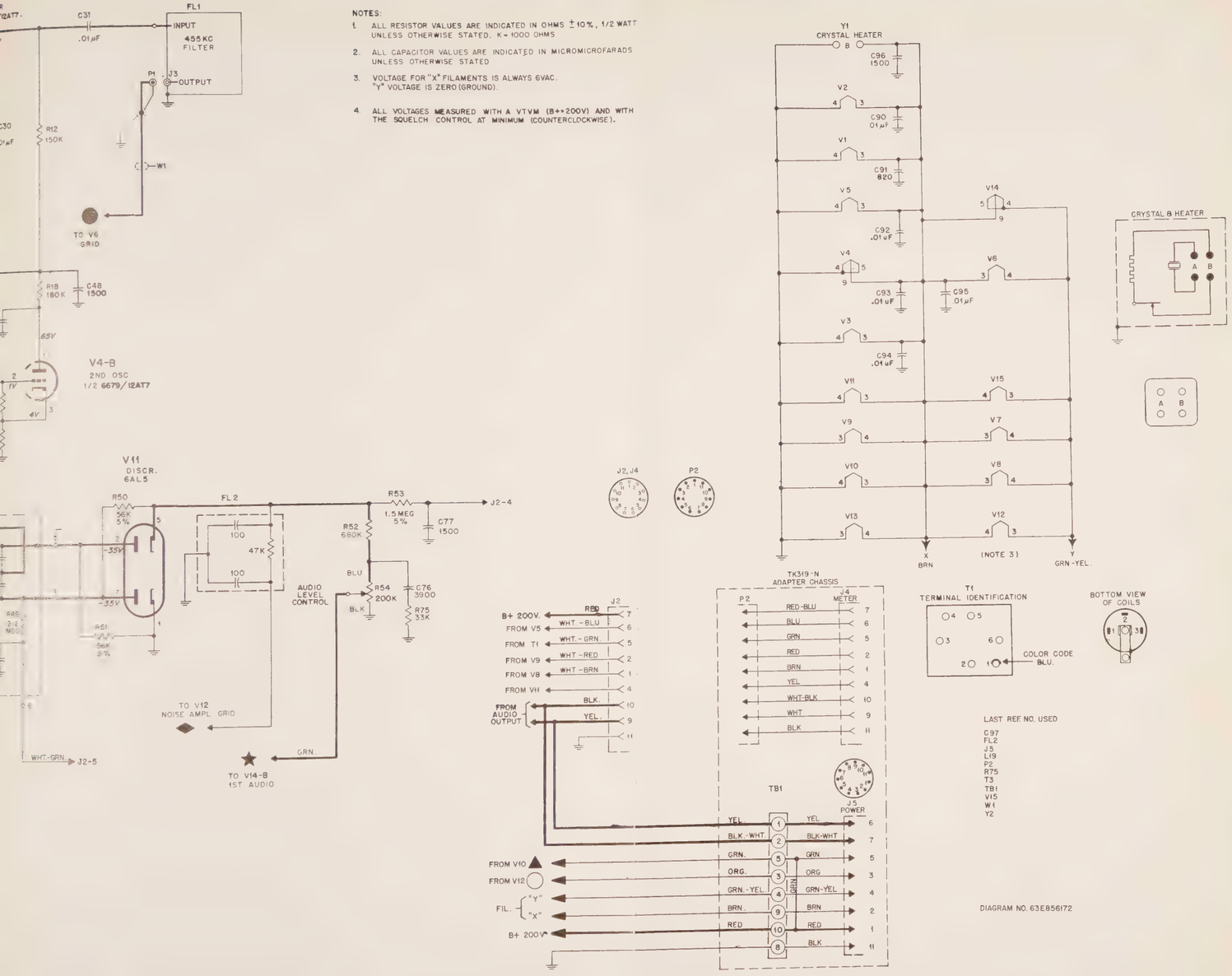
FORMULAS:

$$f_o = \frac{f_c - f_1}{4}$$

$$f_c = 4f_o + f_1$$


J5
POWER
RECEPTACLE
J4 METER
MOUNTING POSTS
(46A855066)
TK319-N
ADAPTER CHASSIS
(BASE STATION)
C49
VOLUME
CONTROL
T1
T2
V11 (6AL5)
V15 (6AQ5)
V10 (6BJ6)
V12 (6BH6)
V9 (6BH6)
V14 (12AT7)
V13 (6C4)
L18
L19
L17
V8 (6CB6)
V6 (6CB6)
SHIELD (26A890034)
V7 (6CB6)
SHIELD (26A890034)
CRYSTAL Y2
HOLD-DOWN-CLIP
(41A824763)
TU145A OR
TU540W FILTER
V4 (12AT7)
SHIELD (26A881244)
L10
L9
L7
L8
V3 (6BH6)
L6
V2 (6AB4)
L4
L5
L3
L15
L16
L2
V5 (6CB6)
SHIELD (26A890034)
V1 (6AK5)
SHIELD (26K890035)
L11
MOUNTING POST
(46K848989)
L1
J1
SPRING CLIP
(41A824763)
HEATED CRYSTAL Y1
(BASE STATION)

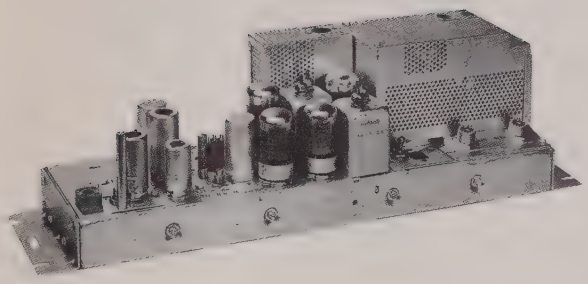

FREQUENCY RANGE
132 - 152 MC
V1
RF
6AK5
V2
1ST MIXER
6AB4
V3
12 MC 1ST I.F. AMP.
6BH6
V5
1ST OSC & MULT
6CB6
V6
455KC I.F. AMPL-1
6CB6
V7
455KC I.F. AMPL-2
6CB6
V8
455KC I.F. AMPL-3
6CB6
V9
1ST. LIM.
6BH6
V10
2ND. LIM.
6BJ6
V12
NOISE AMPL
6BH6
V13
NOISE RECT.
6C4
V14-A
DC AMPL.
1/2 6679 12AT7
V14-B
1ST AUDIO
1/2 6679/12AT7
V15
POWER AMPL
6AQ5
Y1
Y2
12.455 MC
T1
T2
T3
FROM FILTER
B+ 200V
B+
B+ RED
BRN.-YEL.
NOISE FROM FL 2
FROM V10
2ND LIM
TO
TB1-3
TO V12
NOISE AMPL
AUDIO FROM
GRN.
AUDIO OUTPUT
TO SPEAKER
3.2 OHMS
BOTTOM VIEW



Receiver Schematic Diagram
Motorola No. 63E856172-O
3/6/59-UM

TRANSMITTER

CE 937-A



TA192-N TRANSMITTER

1. DESCRIPTION

The MOTOROLA Model TA192-N Transmitter is a single frequency FM transmitter designed for operation in the 132-152 mc band. This transmitter requires a separate power supply chassis to provide operating voltages. The r-f power output of the transmitter power amplifier depends upon the plate and bias voltages. The power supply used with this model is designed for a nominal r-f output of 50 watts.

Basic transmitter circuitry includes a crystal-controlled oscillator, an angular phase modulator controlled by the MOTOROLA IDC (instantaneous deviation control) circuit, three stages of frequency multiplication, a final power amplifier and a harmonic filter. The MOTOROLA IDC circuit is designed to prevent over-modulation, even with very loud signal inputs. The IDC control sets with 100% deviation limit as required for the particular spacing application.

2. THEORY OF OPERATION

a. Audio Input Circuit

A simplified functional diagram of the transmitter audio input circuit is included in this manual. Refer to Diagram No. 63E856104. Note that this is a simplified sketch to illustrate principles. Refer to the schematic diagrams for exact circuit details.

(1) Circuit Paths

There are two circuit paths involved in the transmitter audio input circuit. These are: (a) microphone d-c input, and (b) microphone audio output.

(a) Microphone D-C Input

The microphone d-c input (called talking current) is taken from a B+ source in the transmitter plate feeder. A resistor network drops the MIC D-C voltage to approximately 15 volts. A relatively large capacitor is connected across the circuit to provide additional filtering. The d-c path leads through two resistors to the microphone. These resistors drop the voltage to about 4 volts at the microphone input.

(b) Microphone Audio Output

The microphone acts like a voltage generator in the circuit. Sound waves received by the microphone element produce an output voltage in accordance with the voice frequency and

GUARANTEED PERFORMANCE SPECIFICATIONS

BASIC UNIT	(MOTOROLA Model TA192-N)
FREQUENCY	132-152 mc
CRYSTAL FREQUENCY MULTIPLICATION	Twenty-four (24) times
NOMINAL RF POWER OUTPUT	50 watts (into a 50-72 ohm load)
POWER SOURCE	117 vac, 60 cycle
SPURIOUS EMISSION	All spurious emissions are attenuated at least 70 db below carrier level. All harmonic radiations are attenuated 60 db or more.
FREQUENCY STABILITY AND TEMPERATURE RANGE	Using an oven type crystal, the output frequency is maintained to within .0005% over the ambient temperature range of -30°C to +60°C.
MODULATION	40F3: ±15.0 kc for 100% at 1000 cycles
AUDIO INPUT LEVEL	0.25 volt for 100% at 1000 cycles (approx. -17 db)
PLATE POWER SUPPLY	Separate Unit: 550 volts at 270 ma. 250 volts at 80 ma.
TUBE COMPLEMENT AND FUNCTION	6AK6 - RF Oscillator 7V7 - Modulator 7V7 - Buffer - 1st Doubler 7C5 - Tripler 7C5 - 2nd Doubler 2E26 - Doubler Driver 829B - Final Amplifier 12AX7 - IDC Amplifier 6AL5 - IDC Clipper
NUMBER OF TUNED CIRCUITS	10 total; including three double permeability tuned transformer coupling circuits between multipliers and a multiple tuned output network.
DIMENSIONS	16-1/2" long by 4-7/8" wide by 5-1/2" high
WEIGHT	Approximately 7 lbs.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

intensity. This results in voltage changes at the microphone output as a person speaks into the microphone.

There are two audio sensitivity taps in the microphone output circuit. The position 2 tap connects the full mike output to the transmitter audio amplifier input. The position 1 tap is used for all base station and mobile applications in current production. The position 2 tap can be used if greater audio sensitivity is required in special applications.

The microphone audio output is connected through a coupling capacitor to the grid of the transmitter audio amplifier. The signals are then passed through the IDC circuit and used to modulate the transmitter.

(2) Microphone and Audio Input Details

Audio input details for remotely controlled base stations are shown in the Audio Circuit diagram.

Audio signals originate at a remote control console and are placed on a 500-600 ohm line running to the base station. At the base station remote control unit, a line transformer matches the impedance and couples the signals into the transmitter input circuit. Contacts of the transmit-receive relay close when the push-to-talk button is pressed and complete the circuit to the LINE INPUT control. This control is adjusted to provide a 0.25 volt audio input to the transmitter. The signals are routed to the transmitter and are used to modulate the r-f carrier.

b. Audio Amplifier-Clipper

The incoming signals are amplified by V106 and coupled to the clipper, V107. The clipper stage limits the amplitude of the signals which pass on to the next stage. The clipping level is set so that some clipping of peaks will occur in the normal input signal. Signals applied to the clipper below the clipping level are unaffected by the clipper; signals which exceed the clipping level are clipped at the top and bottom. A small amount of clipping produces a trapezoidal waveform; a large amount of clipping produces a square wave (see Fig. 1).

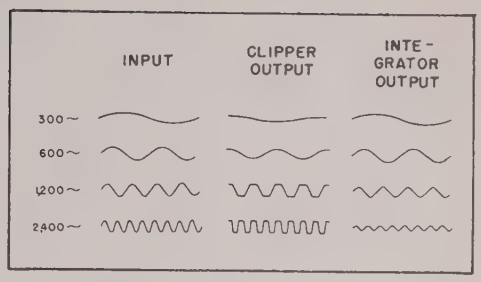


Figure 1.

Basic Waveforms Illustrating the Fundamental Principle

The clipper output is integrated, producing an approximately triangular waveform. The approach to the triangular shape depends upon the amount of clipping; the more clipping, the nearer the output approaches the triangular form (see Fig. 2).

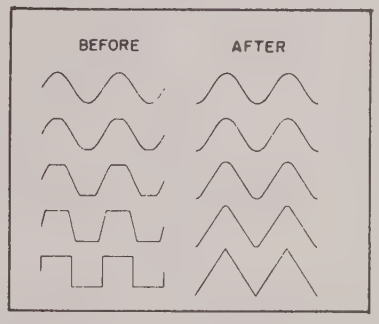


Figure 2.

Sine Waves with Various Degrees of Clipping, Before and After Integrating

The integrating network has the additional function of limiting signal amplitude in proportion to signal frequency. As the frequency increases, the amplitude is reduced in proportion.

The integrator output is amplified and applied to the IDC control, which limits the amplitude of the signals which reach the modulator. The IDC

control limits deviation by controlling the maximum slope (or steepness) of the signal wavefront which reaches the modulator (see Fig. 3).

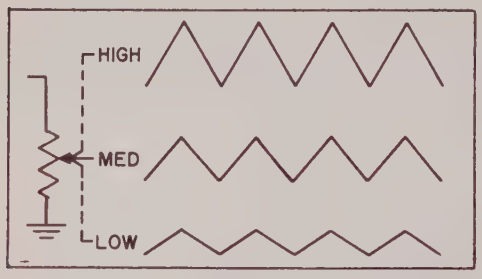


Figure 3.

How IDC Control Sets Steepness of Integrated Square Wave

In the incoming signal from the microphone, wavefront steepness depends upon both amplitude and frequency. The over-all effect of the IDC circuitry is to place a barrier upon the maximum wavefront steepness which can pass into the modulator. The slope of high amplitude signals is controlled by clipping and integrating the square waves which they produce. The slope of high frequency signals is limited to the allowable maximum by reducing the amplitude of these signals.

c. Oscillator-Modulator-Multipliers

This transmitter incorporates a 6AK6 in the crystal controlled oscillator. The oscillator output is fed to the modulator and modulated by the audio applied to the grid. The output of the modulator is multiplied 24 times and is amplified to provide more than adequate drive for the final amplifier. This is accomplished by the associated circuits of two doubler stages, a tripler, and a doubler-driver.

d. Final Amplifier

From the doubler-driver the signal is fed into the final power amplification stage. The signal is filtered of its harmonics by the harmonic filter and is fed into the antenna through the antenna relay.

3. PRE-ALIGNMENT NOTES

When aligning the transmitter preset tuning capacitor's (C104) plates to a position 30° from the fully unmeshed condition.

Meter readings will vary with a change in voltage and will decrease with an increase in the life of the tubes and other components of the transmitter. Each time the transmitter is aligned or tested, the readings should be entered in a logbook.

4. ALIGNMENT PROCEDURE

The alignment procedure for this transmitter is given in the attached alignment procedure chart, part no. EPD-1394.

5. SETTING OF IDC CONTROL

Correct setting of the IDC control is an important factor in the overall operation of the two-way radio communication system. The correct setting is as follows:

For 60 kc channel spacing--±15 kc deviation

The actual measurement of the transmitter deviation involves two important considerations:

a. First: the accuracy of the test equipment being used.

b. Second: understanding the characteristics of the test equipment.

(1) Test Equipment

In this text we shall use the MOTOROLA F4MU-24B Series Frequency Monitor as the basic test instrument. This unit offers the degree of accuracy required for measurement of transmitter deviation as an alternate test equipment Frequency Counter AN/USM-26 with a frequency converter covering the 132-152 mc range, may be used as an indicator of exact operating frequency of the transmitter. Deviation Meter ME-127/U (Browning Laboratories Model MD-33) or equivalent may be used to read deviation.

(2) Instrument Characteristics

In using the F4MU-24B Series Frequency Monitor it is important to understand the action

of the meter. The meter movement actually responds to average voltage. The meter scale, however, is calibrated in terms of peak voltage based on a sine wave signal. When the input waveform departs from a pure sine wave, the meter reading does not indicate the true energy level of the signal. This energy level can be expressed as the ratio of average voltage to peak voltage of the incoming waveform. If this value is above the value for the sine wave, the meter reads high; if this value is below the sine wave value, the meter reads low.

(3) Use of Oscilloscope

An oscilloscope, such as Oscilloscope OS-8/U, can be used along with the frequency monitor to set the IDC control accurately. The oscilloscope is a highly reliable deviation indicator since it is instantaneous in action and the peak reading is unaffected by the waveform. It is strongly recommended that an oscilloscope be used wherever it is available. If no oscilloscope is available refer to the ALIGNMENT PROCEDURE CHART for setting of the IDC control by means of the frequency monitor meter.

Set up the equipment as described in the MEASUREMENT section of the frequency monitor manual (F4M-24B). If the alternate test equipment is used (i.e., Deviation Meter ME-127/U), refer to the appropriate instructions in that equipment's instruction manual for setting up the deviation meter.

Connect the oscilloscope across the discriminator output of the control receiver (pin 5 of V13 on the F4M-24B Frequency Monitor - to ground).

Modulate the transmitter with a 1000 cps tone connected across the microphone input terminals at the transmitter. Connect an AC VTVM across these terminals also.

Calibrate the 'scope as follows: adjust the tone modulation level for a reading of 10 kc deviation on the monitor deviation meter. With a sine wave pattern on the screen use the vertical gain control to set the overall height to a convenient size, e.g., 10 full squares on the screen. This calibrates the 'scope for a reading of 1 square for each kc deviation.

Turn the IDC control to the full clockwise position. Increase the tone level to a minimum of one volt at the audio input terminals. Now turn the IDC control slowly counterclockwise until the height of the pattern represents the required transmitter deviation (±15 kc for 60 kc channel spacing).

PRE-ALIGNMENT NOTES

TEST EQUIPMENT REQUIRED

1. MOTOROLA Portable Test Set, Multimeter AN/PSM-4 (VOM) or Multimeter AN/USM-34 (VTVM)
2. MOTOROLA K-9322 Alignment Tool Kit
3. MOTOROLA F4MU-24B Series Frequency Monitor or Frequency Counter AN/USM-26, with frequency converter covering range of 132-152 mc and Deviation Meter ME-127/U (for oscillator alignment and deviation adjustment)
4. RF wattmeter or dummy antenna
5. Power Supply (preferably the one designed for the transmitter under test)

HOW TO SET UP THE EQUIPMENT

1. Connect the dummy antenna or r-f wattmeter to the transmitter ANT jack.
2. Connect the test set cable plug to the transmitter METER jack, or insert the multimeter test probes into the correspondingly numbered receptacles. See table at right and appropriate column of the alignment procedure chart.
3. Place the test set function selector switch in the XMTR position.
4. Place the GRID CURRENT-METER-FIELD STRENGTH switch in the METER position, on P-8500 and P-8501 Series Test Sets only.
5. Connect the power supply to the transmitter as shown on the intercabling diagram for the equipment.
6. Place the HI-LO switch in the LO position.
7. Turn the equipment on. Allow 30 seconds for the tubes to warm up.

HOW TO KEY THE TRANSMITTER

1. Use the XMTR-ON switch of the test set to place the unmodulated carrier on the air for meter reading and adjustment.

2. Use the MOTOROLA palm-type microphone to key the transmitter and modulate the carrier as required.

CAUTION

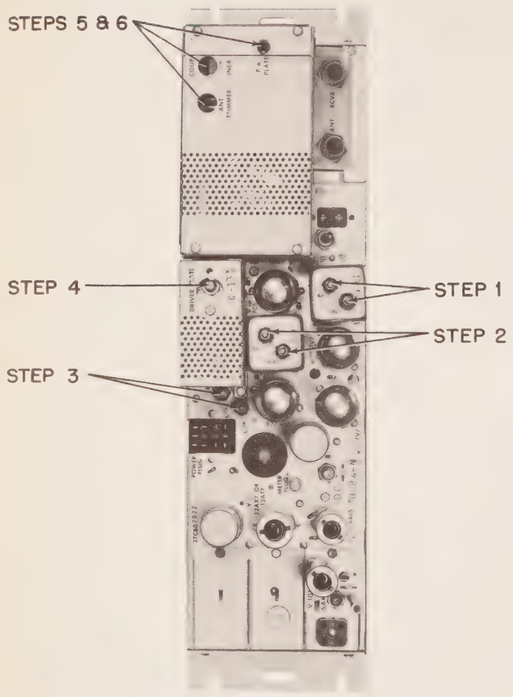
Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Plate current is excessive in untuned stages and may damage the unit. Turn the transmitter on for brief periods while reading the meter and making the adjustment.

EQUIVALENT TEST SET SWITCH POSITIONS

SWITCH POSITION ON TEST SETS	P8500 & P8501 Series:	1	2	3	-4	+4 (PA)	5	6	7	8
	TU546 Series:	1	2	3	4	7	5	6	9	10
CIRCUIT BEING METERED		-	-	Tripler Grid	2nd Doubler Grid	PA Plate Current	Doubler Driver Grid	PA Grid	PA Plate Voltage	Push-To-Talk

FREQUENCY CALCULATIONS

$f_O = \frac{f_C}{24}$ where: f_O = crystal frequency, and f_C = carrier frequency



ALIGNMENT PROCEDURE

STEP	P8500 & P8501 SERIES TEST SET SWITCH POSITION	TU546 SERIES TEST SET SWITCH POSITION	MULTIMETER TEST PROBE AND RECEPTACLE POSITIONS	ADJUSTMENT	METER READING	
1	3	3	Positive to 11 Negative to 3	C104 L106 L107	Maximum	TRI Atta mitt and
2	-4	4	Position to 11 Negative to 4	L108 L109	Maximum	2ND nate
3	5	5	Positive to 11 Negative to 5	L104 L105	Maximum	DOU alte of ab obse plac until
4	6	6	Positive to 11 Negative to 6	C131	Maximum	POW
5	+4 (PA)	7	Positive to 7 Negative to 8	C140 L115 PA PLATE	Minimum	POW coup (SE in t
6	+4 (PA)	7	Positive to 7 Negative to 8	C140 L115 PA PLATE	Maximum r-f output DO NOT EXCEED 200 MA (0.80 volts on a multimeter)	TRA 1. 2.

NOTE

When tuning transmitter to another frequency, remove PA cove
plates of C136 to resonance (rough tuning), WARNING: THERE
VOLTAGE PRESENT - USE AN INSULATED SCREWDRIVER FO
ADJUSTMENT and lock this setting. Replace cover, then proce
just PA PLATE (fine tuning).

STAGE, CONDITIONS AND PROCEDURE

R - Preset C104 to a position 30° from the fully unmeshed condition
ummy load to the antenna connector and the power plug to the trans-
HI-LO switch in LO position Loosen the lock nuts and adjust L106
7 alternately until a definite maximum is obtained.

UBLER GRID - Loosen the lock nuts and adjust L108 and L109 alter-
ntil a definite maximum is obtained

ER DRIVER GRID - Loosen the lock nuts and adjust L104 and L105
ely until a definite maximum is obtained. An immediate meter reading
10 does not indicate alignment of L104 A definite peak will be
d when the circuit is resonant. If the circuit is badly mis-aligned,
e meter selector switch in the STEP 2 position and tune L104 slowly
light dip is noted. Then proceed as outlined in this step.

AMPLIFIER GRID -Adjust C131 until a definite maximum is obtained.

AMPLIFIER PLATE - Turn ANT. TRIMMER C140 for minimum
to the dummy load. Turn L115 fully clockwise to decouple the load
TE BELOW) Adjust PA PLATE for a dip. Place HI-LO switch
I position and readjust PA PLATE for a dip.

ITTER LOADING:

ng R-F Test Load:

ust antenna coupling, L115, for a maximum r-f output, indicated
a maximum wattmeter reading or maximum brilliance of dummy
d lamp. Repeak C140 for a maximum wattmeter reading.

ng Antenna:

enna connected to ANT receptacle. Increase coupling. L115,
ADUALLY while alternately retuning PA PLATE for a dip. Increase
pling until only a slight dip is apparent. When using a microampere
er, multiply reading by 5 to obtain current in ma. Repeak C140 for
ximum.

NOT EXCEED 200 MA. IF THE METER READS OVER 200 MA,
s would correspond to a reading of "40" on the 0-50 ua meter or
0 volts on multimeter). REDUCE THE COUPLING, (L115).

ighten all locknuts loosened during alignment.

adjust
HIGH
HIS
o ad-

METERING TABLE

P8500 & P8501 SERIES TEST SET METER POSITION	TU546 SERIES TEST SET METER POSITION	MULTIMETER TEST PROBE-TO-RECEPTACLE POSITIONS #	METER READING (SEE METER READING NOTES BELOW)	CIRCUIT METERED
3	3	Positive to 11; Negative to 3	25 (NOTE 3)	Tripler Grid
4	4	Positive to 11; Negative to 4	25	2nd Doubler Grid
+4 (PA)	7	Positive to 7; Negative to 8	40 MAXIMUM (NOTE 2)	PA Plate Current
5	5	Positive to 11; Negative to 5	20	Doubler Driver Grid
6	6	Positive to 11; Negative to 6	20	PA Grid
7	9	Positive to 7; Negative to 11 *	Test Sets: 28 (NOTE 4) Multimeter: 560 V DC	PA Plate Voltage
8	10	Positive to 11; Negative to 9 +	Test Set: (NOTE 5) Multimeter: 6 V DC	Push-To-Talk

WHEN USING A MULTIMETER, SOME RESISTANCE MUST BE PLACED IN SERIES WITH THE METER TO PROTECT THE MOVEMENT. FOR EXAMPLE, IF A 0-50 UA METER IS USED THE SERIES RESISTANCE SHOULD BE 20,000 OHMS. READINGS GIVEN IN THE METER READING COLUMN ARE OBTAINED UNDER THESE CONDITIONS.

* WHEN METERING THIS POSITION WITH A MULTIMETER, USE A 600 VOLTS DC SCALE, OR HIGHER, WITHOUT THE SERIES RESISTANCE IN THE METER CIRCUIT.

+ WHEN USING A MULTIMETER, SWITCH TO LOW VOLTAGE SCALE WITHOUT THE SERIES RESISTANCE IN THE METER CIRCUIT.

METER READING NOTES

1. Each time a transmitter is aligned or tested the meter readings should be entered in a logbook.
2. All readings given are minimum except PA, which is maximum. DO NOT EXCEED value given for PA current. This is the maximum plate current to which the unit can be safely tuned. Multiply scale reading by 5 to obtain actual PA plate current in ma.
3. 0-50 ua scale readings are purely relative and do not give actual current or voltage measurement.
4. In position 7 on P8500 & P8501 Series Test Sets, the microampere meter becomes a D-C voltmeter with 1000 volts full scale. Reading shows B+. Multiply microampere scale reading by 20. The TU546 Test Sets have a 0-1000 volt meter scale which is read directly on position 9.
5. This position indicates D-C relay control voltage when transmitter is not keyed. Multiply microampere scale reading by 0.3 when using P8500 & P8501 Series Test Sets.

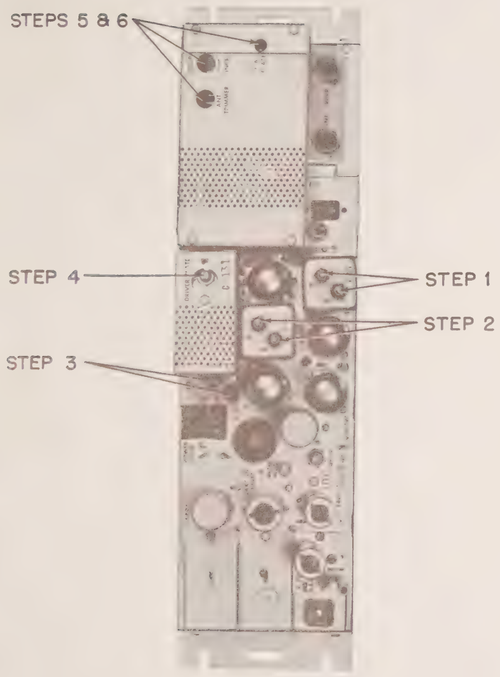
IDC CONTROL SETTING

1. Set up F4MU-24B Frequency Monitor for voice modulation measurement. If an oscilloscope is available, see text for IDC setting using the 'scope.
2. Turn transmitter on and modulate with 1000 cps tone.
3. Adjust the IDC control (R147) on the transmitter chassis until the MODULATION DEVIATION meter on the station monitor reads as outlined in the following paragraph:

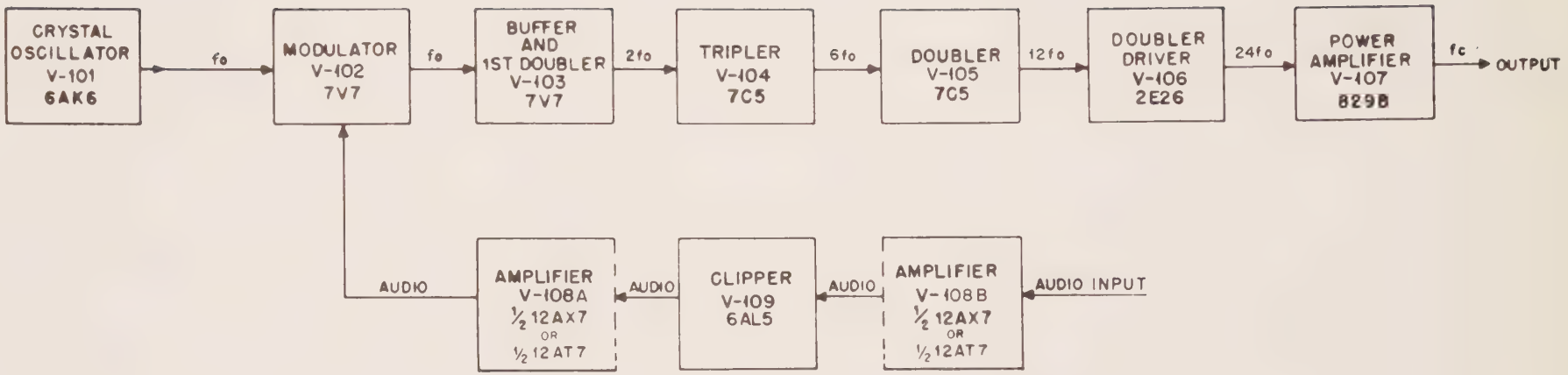
When the transmitter is intended for operation on a 60 kc channel spacing, the IDC control should be adjusted for an approximate 17 kc reading on the station monitor MODULATION DEVIATION METER. Note that a MODULATION DEVIATION METER usually reads average voltage but is calibrated in peak voltage. The setting of 17 kc corresponds to a peak of 15 kc on the MOTOROLA DEVIATION METER. For military equipment, refer to the equipment instructions for calibration of these meters.

SIMPLIFIED ALIGNMENT PROCEDURE

After the serviceman becomes familiar with comprehensive adjustments for this unit, he may use this Simplified Routine Maintenance Alignment Procedure as an alignment check. He should not attempt to use the Simplified Procedure until he has followed complete COMPREHENSIVE ALIGNMENT procedure earlier in this section.



STEP	METER SWITCH POSITION		MULTIMETER TEST PROBE - TO - RECEPTACLE POSITIONS	ADJUSTMENT	METER READING	STAGE AND PROCEDURE
	P-8500 & P-8501 SERIES	TU546 SERIES				
1	3	3	Positive to pin #11 Negative to pin #3	C104 L106 L107	Maximum	V103 PLATE & V104 GRID: Adjust screws alternately (HI-LO switch in LO position).*
2	-4	4	Positive to pin #11 Negative to pin #4	L108 L109	Maximum	V104 PLATE & V105 GRID: Adjust screws alternately.*
3	5	5	Positive to pin #11 Negative to pin #5	L104 L105	Maximum	V105 PLATE & V106 GRID: Adjust screws alternately.*
4	6	6	Positive to pin #11 Negative to pin #6	C131	Maximum	V106 PLATE & PA GRID: Adjust screws alternately.*
5	PA(+4)	7	Positive to pin #7 Negative to pin #8	C140 L115 PA PLATE	Minimum (Dip)	PA: Turn Antenna Trimmer (C140) for minimum plate current. Turn Antenna Coupling (L115) 45° counterclockwise. Adjust PA Plate for minimum meter reading. Place HI-LO switch in HI position and readjust PA Plate for minimum.
6	PA(+4)	7	Positive to pin #7 Negative to pin #8	C140 L115 PA PLATE	Maximum R-F Output DO NOT EXCEED 200 MA (Multimeter reading 0.80 uv)	TRANSMITTER LOADING: 1. Using R-F Test Load: Adjust antenna coupling (L115) for a maximum r-f output, indicated by a maximum wattmeter reading or maximum brilliance of dummy load lamp. Repeak C140 for maximum wattmeter reading. 2. Using Antenna: Antenna connected to ANT receptacle. Increase Coupling, L115, GRADUALLY while alternately retuning PA Plate for dip. Increase coupling until only a slight dip is apparent. When using the microampere meter, multiply reading by 5 to obtain current in ma. Repeak C140 for maximum. DO NOT exceed 200 ma. If the meter reads over 200 ma, (this would correspond to a reading of "40" on the 0-50 ua meter -0.80 volts on multimeter), reduce the coupling. *LOCK must be loosened for adjustments and carefully tightened after adjustments are completed.

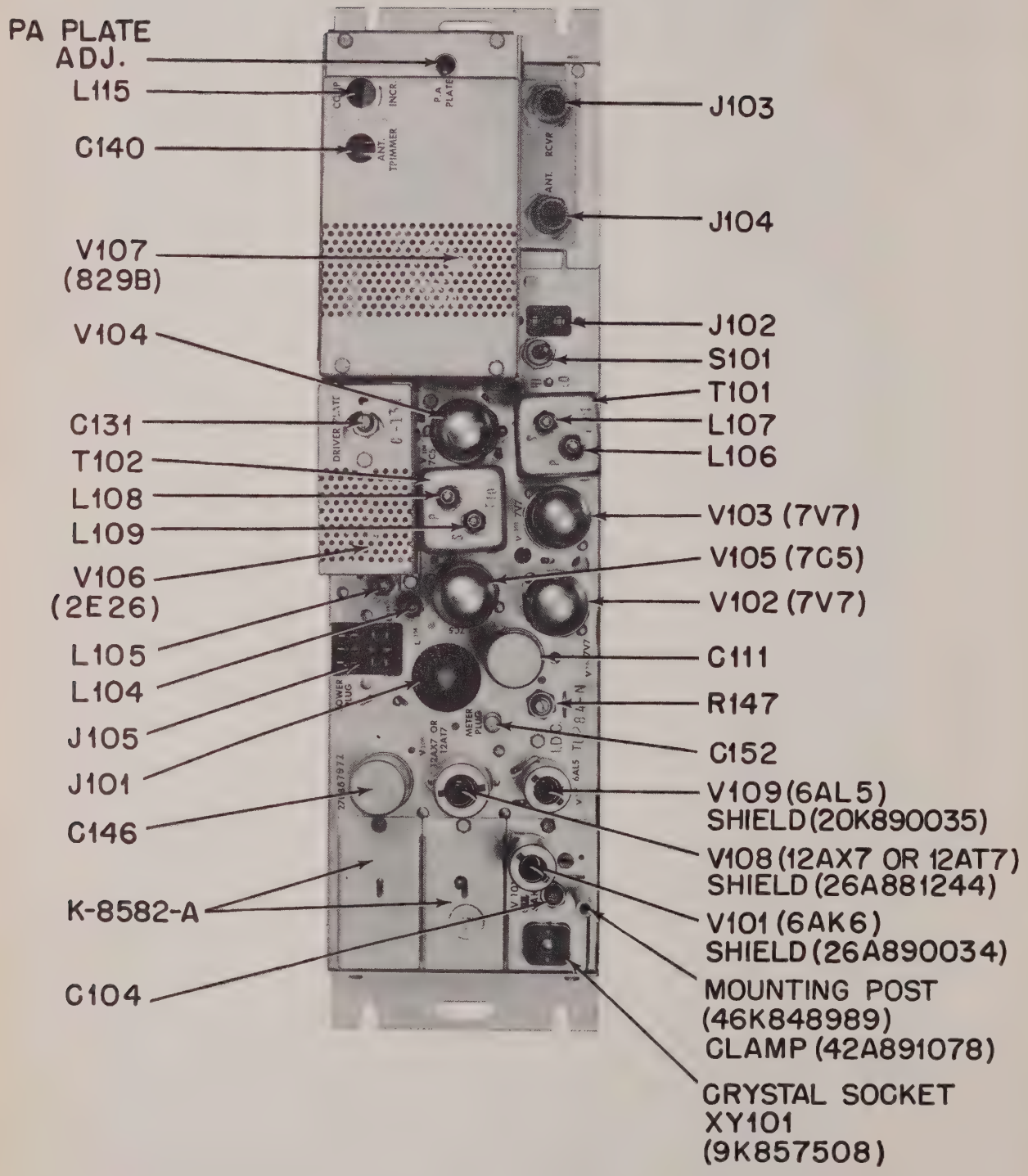


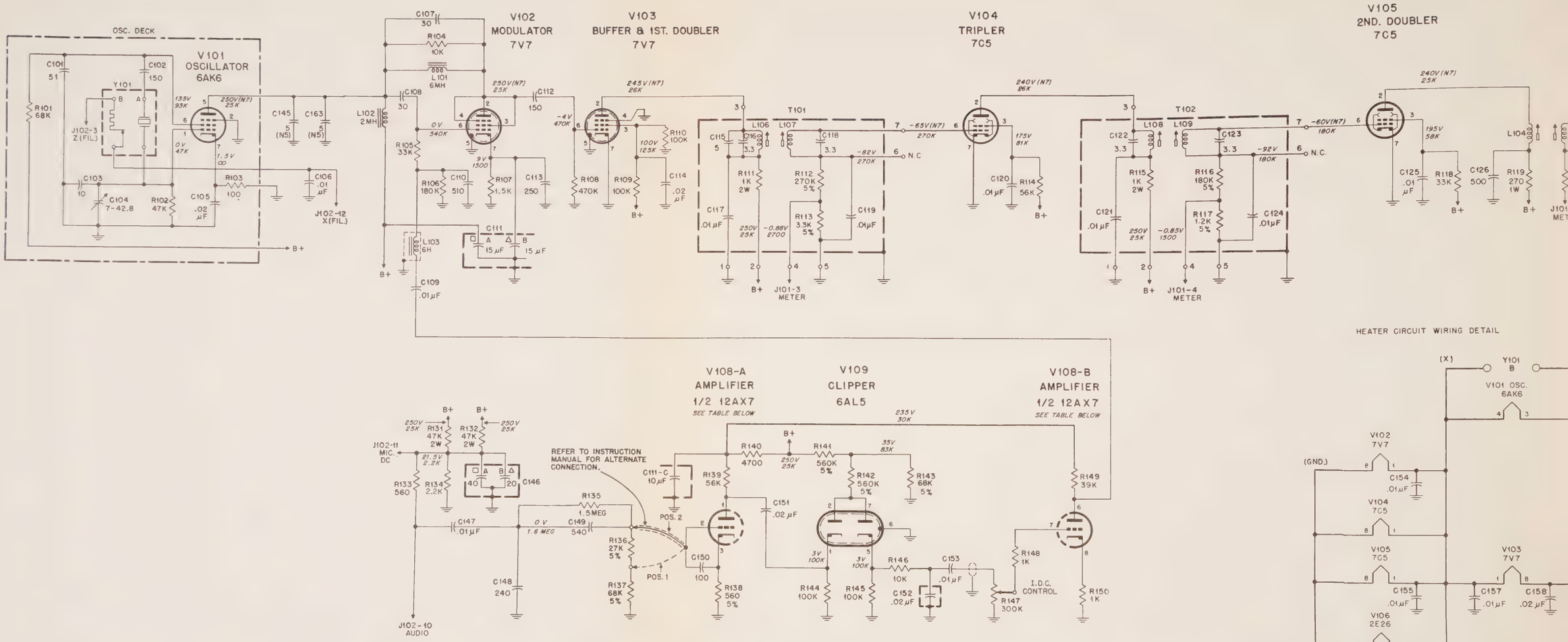
LEGEND

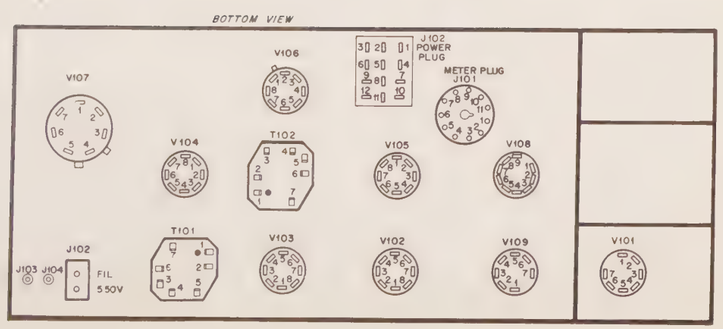
DIAGRAM NO. 63C856174

f_o = OSCILLATOR FREQUENCY
f_c = CARRIER FREQUENCY
$f_o = \frac{f_c}{24}$
$f_c = 24 f_o$
f_o = 5500.0 TO 6333.3 KILOCYCLES
f_c = 132 TO 152 MEGACYCLES

Transmitter Block Diagram
Motorola No. 63C856174-O
3/6/59-UM

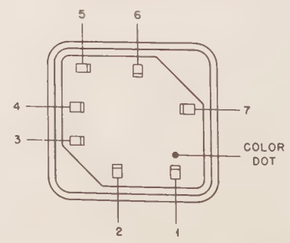

PA PLATE ADJ.
L115
C140
V107 (829B)
V104
C131
T102
L108
L109
V106 (2E26)
L105
L104
J105
J101
C146
K-8582-A
C104
J103
J104
J102
S101
T101
L107
L106
V103 (7V7)
V105 (7C5)
V102 (7V7)
C111
R147
C152
V109 (6AL5)
SHIELD (20K890035)
V108 (12AX7 OR 12AT7)
SHIELD (26A881244)
V101 (6AK6)
SHIELD (26A890034)
MOUNTING POST (46K848989)
CLAMP (42A891078)
CRYSTAL SOCKET XY101 (9K857508)



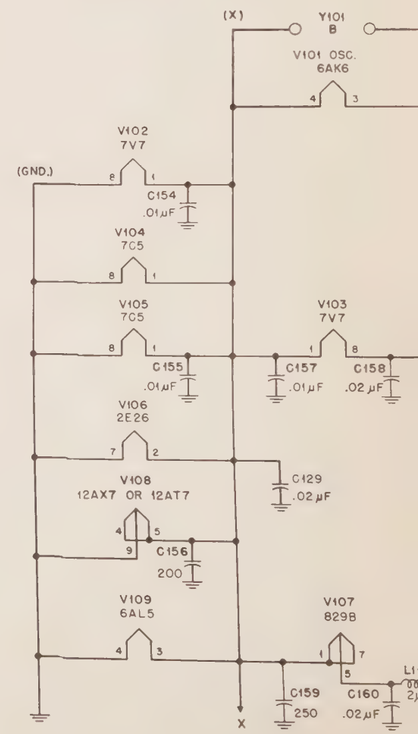


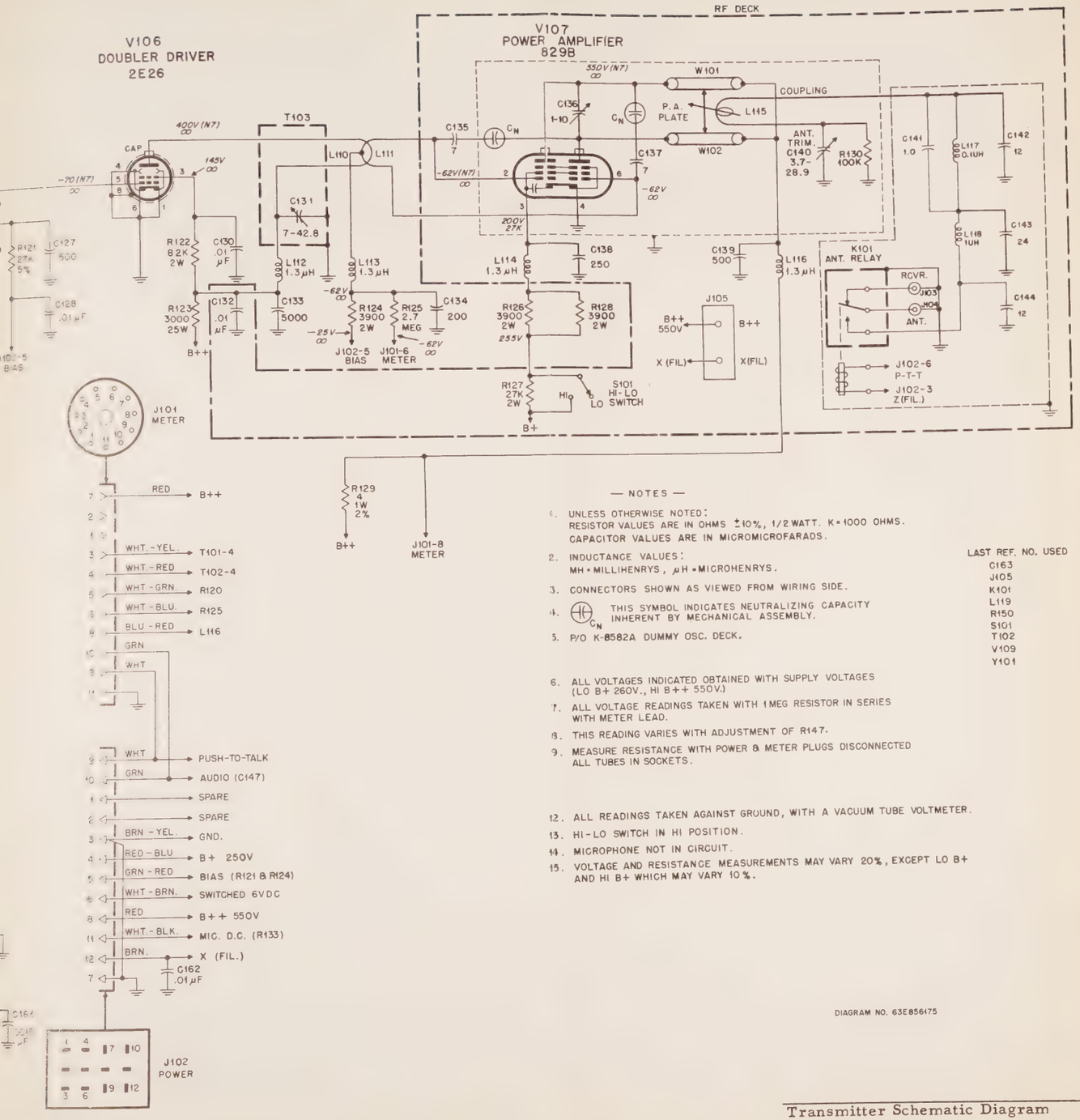
12AX7		
PIN	VOLTAGE	RESISTANCE
1	155	86K
2	0	68K (LO SENS. MIC. TAP) 95K (HI SENS. MIC. TAP)
3	0.85	560
6	190	69K
7	0	NOTE 8
8	1.3	1000

TRANSFORMERS T101 & T102
TERMINAL IDENTIFICATION



HEATER CIRCUIT WIRING DETAIL





— NOTES —

1. UNLESS OTHERWISE NOTED:
   RESISTOR VALUES ARE IN OHMS ±10%, 1/2 WATT. K = 1000 OHMS.
   CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. INDUCTANCE VALUES:
   MH = MILLIHENRYS, μH = MICROHENRYS.
3. CONNECTORS SHOWN AS VIEWED FROM WIRING SIDE.
4. C_N THIS SYMBOL INDICATES NEUTRALIZING CAPACITY INHERENT BY MECHANICAL ASSEMBLY.
5. P/O K-8582A DUMMY OSC. DECK.
6. ALL VOLTAGES INDICATED OBTAINED WITH SUPPLY VOLTAGES (LO B+ 260V., HI B++ 550V.)
7. ALL VOLTAGE READINGS TAKEN WITH 1 MEG RESISTOR IN SERIES WITH METER LEAD.
8. THIS READING VARIES WITH ADJUSTMENT OF R147.
9. MEASURE RESISTANCE WITH POWER & METER PLUGS DISCONNECTED ALL TUBES IN SOCKETS.
12. ALL READINGS TAKEN AGAINST GROUND, WITH A VACUUM TUBE VOLTMETER.
13. HI-LO SWITCH IN HI POSITION.
14. MICROPHONE NOT IN CIRCUIT.
15. VOLTAGE AND RESISTANCE MEASUREMENTS MAY VARY 20%, EXCEPT LO B+ AND HI B+ WHICH MAY VARY 10%.

LAST REF. NO. USED
C163
J105
K101
L119
R150
S101
T102
V109
Y101

DIAGRAM NO. 63E856175

Transmitter Schematic Diagram
Motorola No. 63E856175-A
3/6/59-UM

POWER SUPPLY

DESCRIPTION

The MOTOROLA Model P-8464-N Power Supply is designed to provide all of the voltages required for the operation of a Motorola fixed frequency communications transmitter and receiver.

Adequate primary overload protection of the transmitter, receiver and relay power circuits is provided by five (5) cartridge type replaceable fuses. A pair of Type 5R4GY vacuum tube diodes are connected for full wave rectification to provide the required transmitter high voltages. Selenium full wave rectifiers are employed in the receiver and relay power circuits.

In addition to the rectifier circuits, the power supply chassis contains a microphone connector for local transmitter operation and a transmit-receive relay which provides the necessary receiver B+ muting facilities.

PERFORMANCE SPECIFICATIONS

PRIMARY POWER SOURCE	117 volts, 60 cycles, single phase, 2 wire	
TUBE COMPLEMENT	Two 5R4GY RECTIFIER	
OUTPUT RATINGS	Transmitter Section	Receiver Section
	550 VDC at 270 ma 250 VDC at 80 ma -26 VDC Bias 6.3 VAC at 10.5 A 6 VDC at 1 A	190 VDC at 75 ma
DIMENSIONS	19" long x 6-1/4" wide x 7-1/4" high	
WEIGHT	38 lbs.	
MOUNTING	Standard 19" rack installation	

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

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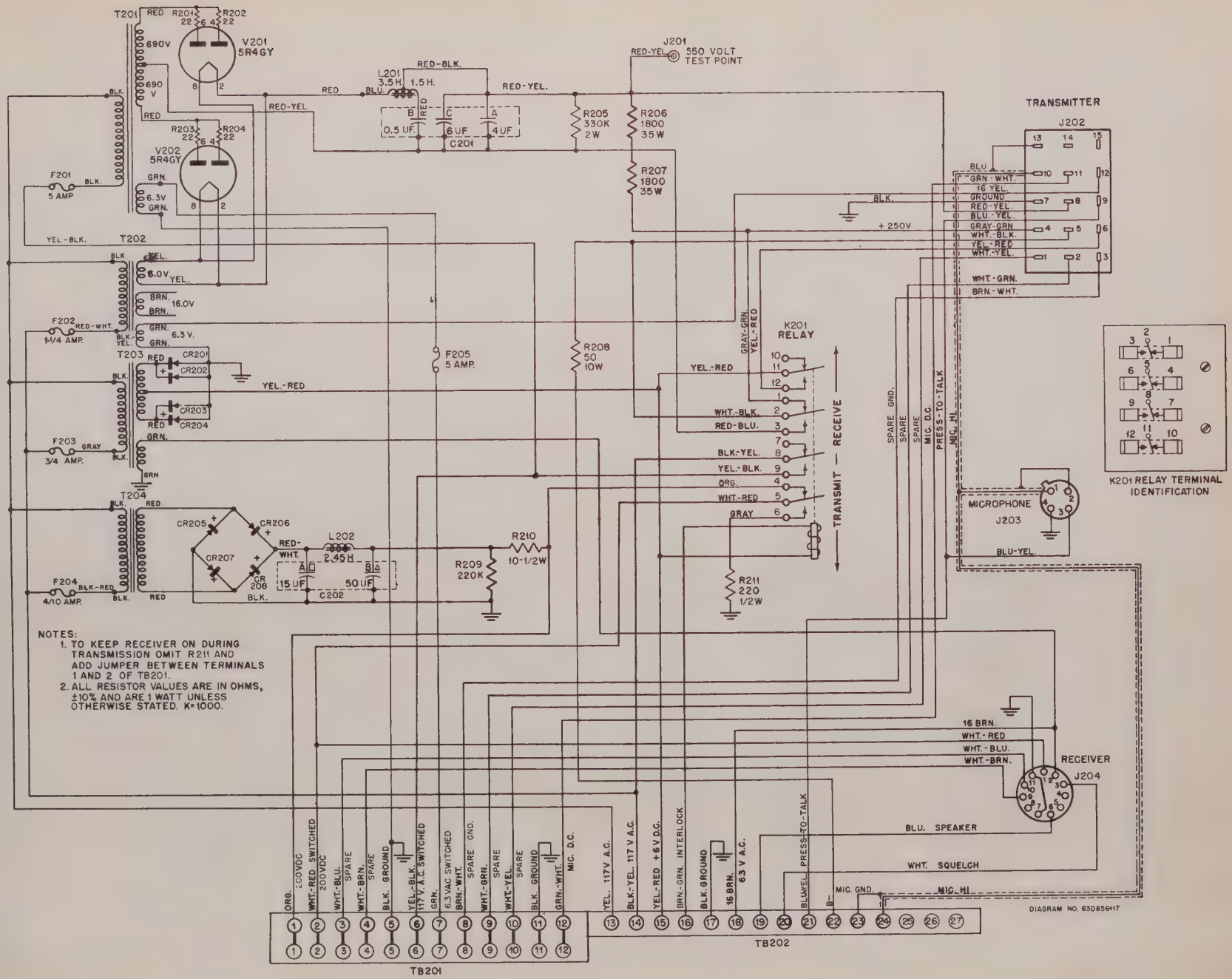
3/6/59-UM 68P856116-O

Power Supply Schematic Diagram
Motorola No. 63D856117-A
3/6/59-UM



NOTES:
1. TO KEEP RECEIVER ON DURING TRANSMISSION OMIT R211 AND ADD JUMPER BETWEEN TERMINALS 1 AND 2 OF TB201.
2. ALL RESISTOR VALUES ARE IN OHMS, ±10% AND ARE 1 WATT UNLESS OTHERWISE STATED. K=1000.

REMOTE CONTROL CHASSIS

P-8066-N-N

MODEL	APPLICATION
P-8066-N-N	One single-frequency transmitter and one single-frequency receiver.

1. DESCRIPTION

The P-8066-N-N Remote Control Chassis is designed for application in single-frequency remotely controlled base station models. All standard remote control functions for the station are administered by this chassis. The remote control chassis serves as the terminal facility for the 500/600 ohm 2 or 4 wire control line from the associated remote control console. DC control voltages as received via the control line from the remote console are translated by the remote control chassis into specific operating functions for the base station. The necessary receiver squelch control, control relay, and line input transformer for the transmitter and receiver are incorporated on this chassis.

2. APPLICATION

The P-8066-N-N Remote Control Chassis is used in all remotely controlled base station models employing one single-frequency transmitter and receiver. The chassis includes the receiver SQUELCH control, transmit-receive relay, and LINE INPUT control.

The SQUELCH control is used for squelching the receiver at the remote control chassis. The LINE INPUT control is for adjusting the audio input level from the remote control unit to the transmitter modulator. The transmit-receive relay is actuated by a 8 ma direct current from the remote control console. The functions of the transmit-receive relay are as follows:

a. Connects the audio input from the remote control console to the transmitter modulator input when the remote control console is in the transmit condition.

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b. Connects the receiver audio output to the control line in the receive condition.

c. Controls the transmit-receive relay on the power supply chassis.

3. OPERATION

Operation of this remote control chassis is dependent upon application of a control voltage from an external source such as a remote control console. Operation with a MOTOROLA Remote Control Console is as follows:

a. To Transmit:

To transmit, depress the push-to-talk switch on the microphone or foot switch. When the push-to-talk switch on the microphone is depressed, a DC voltage from the console power supply is impressed across the line to produce an approximate +8 ma current flow through the control line. This current energizes the "transmit-receive" relay on the transmitter remote control chassis. Actuation of this relay keys the transmitter and simultaneously switches "off" receiver B+ rendering the receiver inoperative.

b. To Receive:

Release push-to-talk switch. Receiver B+ is restored and audio output may be heard at the remote control console. Receiver audio is fed to the control line via the 3 ohm primary winding of line transformer on the remote control chassis.

4. SYSTEM ADJUSTMENTS

a. Squelch Adjustment

Place the SPEAKER switch on the audio panel in the SPEAKER ON position. With no signal received, turn the SQUELCH control on the remote control chassis from the full counterclockwise position (open squelch), slowly, in the clockwise direction until the speaker is just quiet (noise squelched). Do not advance the control beyond the point of just squelching the noise. Further clockwise rotation of the control will increase the minimum signal necessary to open the squelch circuit.

b. Volume Adjustment (On Receiver)

Connect a db meter or a line level meter across terminals 7 and 8 in the bottom row of terminals of the terminal board on the rear of the remote control chassis. Adjust the VOLUME control on the receiver to obtain zero db or a reading of 1.73 volts peak with normal signal being received. (CAUTION: Do not use unsquelched receiver noise.)

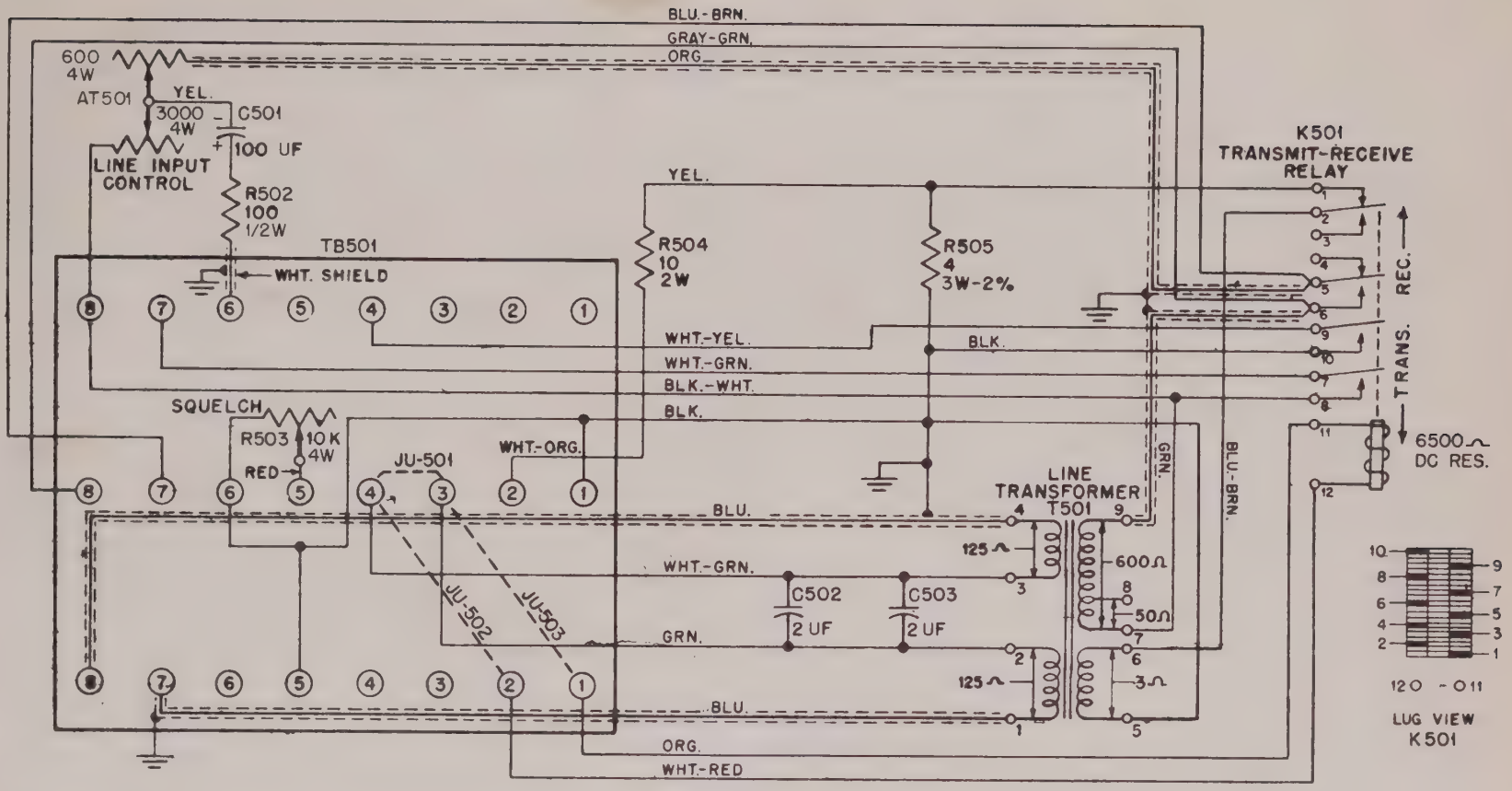
c. Line Input Control Adjustment

The LINE INPUT control on the remote control chassis establishes the audio input level from the remote control console to the transmitter.

Two suggested methods of adjustment in the order of preference are listed following. Be sure Remote Console level adjustments are made before proceeding with LINE INPUT adjustments.

(1) The LINE INPUT control may be set by a means of a high impedance VTVM (Hewlett Packard Model 400A voltmeter, multimeter AN/USM-34 or equivalent) connected across terminals 6 and 8 top row on the remote control chassis (grounded side of the meter connected to terminal 8). With a 1000 cycle tone or the Alert Tone signal from the console fed into the control line at zero level at the remote control point, the LINE INPUT control should be set to give a 0.25 volt reading.

(2) Park a mobile unit approximately one mile from the station to be adjusted and connect an audio output meter across the 3 ohm speaker terminals of that equipment. If an output meter is not available, a MOTOROLA Portable Test Set connected to the METER receptacle of the receiver may be used for this purpose. Station one operator at the mobile station, another operator at the base station and a third operator at the remote control console. Have the console operator alternately transmit the 1000 cycle test tone or the alert tone signal from the console at 5 second "on" and "off" intervals. These tones should be transmitted at a zero db. level as indicated on the console meter. Have the base station operator increase the LINE LEVEL control in sequential steps, starting from the extreme counterclockwise position, for each interval that the signal is being transmitted. During the "off" signal period, have the mobile operator call back to the station and read out the maximum meter reading for that interval plus the reading attained at the end of the previous "on" period. Repeat this procedure until the reading at the mobile station reaches its maximum and just begins to decline with further increase in LINE LEVEL adjustment.



NOTE:

1. K501 IS SHOWN IN RECEIVE POSITION.

JUMPER TABLE

APPLICATION	JU-501	JU-502	JU-503
2 WIRE REMOTE CONTROL	OMIT	USED	USED
4 WIRE REMOTE CONTROL	USED	OMIT	OMIT

DIAGRAM NO. 63C856107

MODEL CHART

MODEL	APPLICATION
P-8066-NN	BASE STATION

Remote Control Chassis
Schematic Diagram
Motorola No. 63C856107-B
3/6/59-UM

BASE STATION MAINTENANCE

1. GENERAL

This section outlines the specific duties and responsibilities of maintenance personnel. Experience has shown that there is a particular way of maintaining two-way communications equipment that is far superior to any other in achieving maximum operating efficiency and reliability. This procedure is known as "System Maintenance", which simply means that the inspection and maintenance of all units constituting the communication system is conducted in an established and orderly fashion. It is recommended that the procedure should be conducted at regular intervals.

All communications systems include integrated assemblies. A failure in any one of these would constitute a failure of communications. They are three major factors which require attention:

a. The primary power source.

b. The basic radio units.

c. The antenna system.

Any successful maintenance program must include the entire system. It would be of little consequence to maintain the basic radio units at top efficiency only to ignore the primary power or the antenna system. A failure in either one results directly in a failure of radio communications. Therefore, to be successful in maintenance, a program should be developed and closely followed on a basis of all-inclusive system maintenance. Such a program should include a periodic check on all the factors constituting the FM Two-Way Radio communication system.

This section recommends specific duties and responsibilities of maintenance personnel. The two phases of maintenance are the preventive maintenance measures and the repair of the equipment when it breaks down. Preventive maintenance is performed on equipment to insure good working condition so that break down and needless interruptions in service will be kept to minimum. Preventive measures include visual inspection of electrical and mechanical parts, periodic cleaning, and lubrication. These techniques can be performed with a minimum of equipment and effort. Potential failures can often be spotted and corrected before they have a chance to develop. Systematic recording of meter readings and studying of performance characteristics also aid in the prevention of failures. Comparison of data, taken on a particular equipment at regular intervals, reveals slow progressive drifts that may be too small to show up significantly in one test. Any marked variations in the regularly obtained data should be regarded as a sign of an approaching failure and investigated promptly.

NOTE

Due to the particularity of some equipment chassis, special maintenance considerations are included in the respective instruction sections for these units. Refer to these instruction sections for further information.

2. ROUTINE MAINTENANCE

The following chart is part of the regular preventive maintenance procedure. These procedures should be performed at least as often as recommended. Under adverse conditions, such procedures as cleaning and inspecting for signs of deterioration of exposed components should be performed more often depending upon the conditions encountered. The purpose of routine maintenance is to prevent certain troubles from occurring.

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ROUTINE MAINTENANCE CHECK CHART

What to Check	How to Check	Explanation
	WEEKLY	
1. Cleaning	Clean dirt and moisture from exterior of equipment.	Remove loose dust and dirt with a soft brush or blower; remove dirt and grease which adheres to the chassis and parts with a brush or cloth moistened with a cleaning solution. Wipe gently with a clean soft cloth such as cheese cloth.
2. Inspecting	Inspect parts and wiring for rust corrosion, loose connections, frayed and burned insulation, loose screws, and burned and charred resistors and coils.	Use #0000 sandpaper to remove rust and corrosion. Do not use steel wool or emery cloth as minute particles frequently enter the equipment and cause harmful internal shorting or grounding of circuits. Use paint which is authorized and consistent with existing regulations to touch up bared surfaces.
3. Controls	Inspect for binding scraping, excessive looseness, misalignment, and positive action. Tighten knobs or controls, if necessary.	Replace if necessary.
4. Plug-in items	Inspect the seating of readily accessible plug-in items such as tubes, lamps, crystals, fuses, and plug-in type transformer.	Replace if necessary.
5. Cables	Inspect cables for cuts, breaks, fraying deterioration, kinks, and strains.	Repair or replace if necessary.
6. Connectors	Inspect for loose connections and bent or broken contacts.	Straighten all bent contacts. Replace if contacts are broken.
7. Pilot light Assemblies	Inspect for looseness, broken lenses, and burned out bulbs.	Replace if necessary.
8. Dust Covers	Check to see that all protective dust covers are in place.	
9. Meters	Inspect meters for damaged glass and broken cases.	Replace if necessary.
10. Antenna Tower guy wires (if used)	Check for proper tension.	Tighten all guy wires for equal tension on each corner.

ROUTINE MAINTENANCE CHECK CHART (Cont'd.)

What to Check	How to Check	Explanation
	WEEKLY (Cont'd)	
11. Mountings and connections	Clean and tighten exterior of components and cases, rack mounts, antenna mounts, shock mounts, coaxial cables, and cable connections.	Tighten screws, bolts and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.
12. Power Supply Voltages	Check for proper power supply voltages by observing indications on the appropriate meters.	Each voltage on each transmitter and receiver must be checked to determine that the power supply voltages are correct.
	MONTHLY	
1. Tubes	Inspect for loose envelopes, cracked sockets, insufficient spring tension. Check emission of receiver type tubes.	Replace all defective tubes.
2. Terminal Boards	Inspect for loose connections, cracks, and breaks.	Replace if necessary.
3. Transformers, Chokes, Potentiometers	Inspect for signs of overheating.	Replace if necessary.
4. Electrical Connections	If necessary, tighten all electrical connections, terminal strips, etc.	Do not tighten beyond the pressure for which they are designed.
5. Capacitors	Inspect fixed capacitors for leaks, bulges, and discoloration. Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mounting.	Replace if defective.
6. Resistors	Inspect for cracks, chipping, blistering, discoloration and moisture.	Replace if defective.
7. Switches	Clean and tighten switches, terminal blocks, and interior of chassis.	

3. TYPICAL ADDITIONAL CHECKS

NOTE

Due to the particularity of some equipment chassis, special maintenance considerations are included in the respective instruction sections for these units. Refer to these instruction sections for further information.

a. Fuses

Fuses, sometimes even when new, may have too much resistance. Check and replace if voltage drop exceeds .1 volt.

b. Fuse Holders

Fuse holders also lose their temper because of heat resulting from poor contact. Acid causes

corrosion. Accumulation of oil and dirt increases contact resistance and the remedial action is to clean contacts, tighten or replace.

c. Primary Power Source

Primary voltages are always suspected in AC circuits as they can often be too high as well as too low. In some cases application of voltage regulators may be necessary. Loose connections on fuses occur even in AC circuits. Check for hot fuses and connections.

Primary power sources should be the first check points in preventive maintenance procedures and should be checked periodically.

d. Unit Assemblages

These include the transmitter, receiver, power supply, and associated units. Very few adjustments need to be made regularly in the transmitter and receiver. To catch a maximum number of incipient troubles, the technician must use his eyes, his ears, his sense of touch, and meter measurements, as well as his good judgment and past experience.

Basically four types of observations are required:

(1) Listening Tests

An experienced technician can often detect warnings of impending trouble by noting the audio quality, the noise background and the squelch operation in relation to the settings of the volume and squelch controls. He will come to know the normal signal level he should obtain at given locations with selected stations in a particular system. Degradation of performance will be immediately apparent to the technician who checks the set periodically, whereas the steady operator may become accustomed to a gradually degraded performance.

(2) Visual Inspections

Check for loose bolts, screws and clamps, worn microphone cords, burned out pilot lights, arcing conditions at any point in the equipment, loose or broken components, burned resistors, or loose connections. A good visual inspection not only means quick locating of the trouble source, but may prevent more serious trouble from developing later.

(3) Touch Tests

WARNING

When making touch tests on the equipment the technician should be extremely careful, as HIGH VOLTAGES ARE PRESENT AT ALL TIMES. Extreme caution should be observed to avoid hazardous electrical shocks. Even after the AC power is disconnected from the equipment, short out the high voltage components to chassis ground by means of a screwdriver with insulated handle.

The fingers are good detectors of improper temperature conditions. Fuses, fuse holders, crystal ovens, transformers and relay coils which are too hot indicate possible trouble sources. Also, cold crystal ovens (except for non-heated crystals), tubes or resistors that should normally be warm are probably in trouble. Such tests are quick and should be used often.

(4) Meter Measurements

Actual quantitive measurements of voltages, grid and plate currents, power output, frequency and deviation have no substitute; their meaning is definite. Experience will indicate to what degree variations can be tolerated.

e. Antenna Systems

Visual checks of antennas, line and tower lights, antenna mounting devices, cables, and connectors should be made periodically, as well as meter checks to find any open or shorted lines or high standing wave ratios. Remember that the antenna must efficiently radiate the power developed in the transmitter and also transfer to the receiver the minute voltages picked up from the distant transmitter to produce a good audible signal. Failure of the antenna or antenna line is a failure of the communications systems.

f. Netting

Netting of receivers and transmitters in any system is more important than usually realized. The term "netting" means that all receivers and transmitters in a given system are aligned on the same frequency. With modern selectivity requirements, it is more than ever necessary to tune every receiver exactly to the station it must receive. Careful "netting" of all units in an integrated system to the correct frequency is a first order requirement of any communication

system and will eliminate a prime cause of poor system performance.

g. Frequency Checks

Frequency checks of transmitter deviation will also improve poor system operation. The technician should be sure that transmitters are swinging through the entire deviation range as under-deviation does not develop the full advantages of frequency modulation.

A good rule to follow is to check performance frequently and make adjustments only when actual tests and measurements prove improper operation. Do not make any unit adjustments without meter and signals to indicate actual conditions.

h. Rustproofing and Painting

When the finish on the components has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surfaces. Use #0000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

CAUTION

Do not use steel wool or emery cloth. Minute particles frequently enter the equipment and cause harmful internal shorting or grounding of circuits.

4. REQUIRED REPAIRS

a. Tagging Leads

Tagging of leads is essential to assure that correct re-wiring will be made when a part is replaced. Before unsoldering any leads, tie together the leads that are attached to each part.

Use small tags or short pieces of adhesive tape to identify all wires in accordance with their actual connections. Identify every lead that is to be removed.

b. Parts and Substitutions

When damaged parts must be replaced, identical parts should be used. If the identical replacement component is not available, check the parts list of the respective chassis for proper MOTOROLA part number and order the components from the nearest MOTOROLA replacement parts depot as listed in the **FOREWORD** of this instruction manual. If for any reason, substitutions must be made immediately, it is recommended to replace the substitutions as soon as the proper replacement part is available. Even the substituted part must have identical electrical properties and must be of equal or higher voltage and current ratings.

c. Location

Relocation of a substituted part may develop hum or other interference and is not recommended.

d. Mounting

Mount the new or repaired part in the same mounting as that formerly used by the damaged part. Fasten all mountings securely.

e. Soldering

Before soldering any connections, carefully scrape all parts that will be touched by the solder until all traces of rust, corrosion, paint or varnish are removed. Dust the scraped parts with a small clean brush. Tin all surfaces to be soldered. Wrap the wire around the lug to be soldered to obtain sufficient mechanical support. Solder the connection, using a minimum amount of solder with sufficient heat to make the solder flow evenly around the tinned surface.

5. SUMMARY OF RECOMMENDED CHECKS

A good preventive maintenance program would require a complete system check at least every three months preferably monthly or weekly. In a general way the following items should be part of any preventive maintenance routine.

a. Clean and dust thoroughly.

b. Check primary voltage circuits.

c. Measure all required B+ voltages.

d. Measure power output of transmitters.

e. Measure sensitivity of receivers.

f. Check meter reading at the metering positions of transmitters and receivers.

g. Check audio output of receivers and audio input to transmitters.

h. Check DC control voltages at control panels.

i. Check operation of all relays and clean relay contacts.

j. Measure frequency and deviation of transmitters.

k. Check and adjust frequency netting of the entire system.

l. Check all accessories; such as cables, microphones, pilot lights, etc.

m. Check the antenna system and clean antenna of any dirt or corrosion.

n. Check telephone lines, A.C. line, and antenna coaxial lines.

o. Check and adjust remote control levels.

p. Check power supply output voltages.

q. Actually make an operational listening test of transmission and reception.

r. Keep individual records of each unit.

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d. Mounting

Mount the new or repaired part in the same mounting as that formerly used by the damaged part. Fasten all mountings securely.

e. Soldering

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k. Check and adjust frequency netting of the entire system.

l. Check all accessories; such as cables, microphones, pilot lights, etc.

m. Check the antenna system and clean antenna of any dirt or corrosion.

n. Check telephone lines, A.C. line, and antenna coaxial lines.

o. Check and adjust remote control levels.

p. Check power supply output voltages.

q. Actually make an operational listening test of transmission and reception.

r. Keep individual records of each unit.

TABLE 1-1 LIST OF MAJOR UNITS

REF. DESIG.	QUANT.	NAME OF MAJOR UNIT	UNIT DESIGNATION	COLLOQUIAL NAME	DIAG. NO.
1- 99	1	RECEIVER, RADIO		TA140BWQ-N	63E856172
100-199	1	TRANSMITTER, RADIO		TA192-N	63E856175
200-299	1	POWER SUPPLY		P8464-N	63D856117
300-399	1	ANTENNA	AT-853/FRC-59	DS9664	85D858581
400-499	1	SUBASSEMBLY, audio panel		TU582	63E856103
500-599	1	CONTROL, RADIO SET		P8066-NN	63C856107
600-699	1	CABLE ASSEMBLY, SPECIAL PURPOSE ELECTRICAL		K8682-N	63E856103
700-799	1	SUBASSEMBLY, fuse and AC panel		P8659-C	63E856103
800-899	1	MICROPHONE, DYNAMIC	M-90/U	TU351A-N	63E856108

New Stock Number Identification Tables (SNITs) issued by the Electronics Supply Office include Federal Stock Numbers and Source, Maintenance and Recoverability Codes. Therefore, reference shall be made to the SNIT for this information.

TABLE 1-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
A801	AMPLIFIER, AUDIO FREQUENCY: single transistor stage; MOTL pt. no. 1V852720	Amplifier for microphone output
AT401	ATTENUATOR, VARIABLE: wire wound; "L" pad type; dual section; front section, 3 ohm, 2 w, rear section, 15 ohm, 2 w, constant resistance of output is 3 ohm; MOTL pt/dwg no. 18A16537	Speaker pad volume control
AT501	RESISTOR, VARIABLE, WIRE WOUND: 600 and 3000 ohm; 4 w; MOTL pt/dwg no. 18A811698	Line input control
C1	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10 uuf, ±0.5 uuf; 500 vdcw; MOTL pt no. 21R124710, dwg no. 21R400533	Tank circuit (P/O L1)
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 56 uuf, ±5%; 500 vdcw; temp coeff N750; disc type; two radial type wire leads; MOTL pt no. 21K863623, dwg no. 21D832522	Tank circuit (P/O L1)
C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 24 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840365, dwg no. 21D832522	V1 grid coupling
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 820 uuf, ±10%; 500 vdcw; MOTL pt/dwg no. 21B837745	V1 grid bypass
C5	Same as C4	V1 screen bypass
C6	Same as C4	L2 feedback filter
C7	CAPACITOR, FIXED, COMPOSITION DIELECTRIC: 0.15 uuf, ±5%; 500 vdcw; MOTL pt no. 21K881064 dwg. no. 21C83959	L3 coupling
C8	Same as C1	L2 tank circuit
C9	Same as C4	L2 feedback filter
C10	Same as C7	L4 coupling
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 16 uuf, ±5%; 500 vdcw; MOTL pt no. 21K857228, dwg no. 21D832522	L3 tank circuit

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C12	Same as C1	L4 tank circuit
C13	Same as C3	V2 grid coupling
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 51 uuf, ±5%; 500 vdcw; temp coeff N80; disc type; two radial wire type leads; MOTL pt no. 21K838729, dwg no. 21D832522	L5 tank circuit
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1500 uuf, -0+100%; 500 vdcw; MOTL pt/dwg no. 21B800801	L5 feedback filter
C16	Same as C7	L6 coupling
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC: .01 uf, -20+80%; 600 vdcw; MOTL pt/dwg no. 21B801139	L5 feedback filter
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 15 uuf, ±5%; 500 vdcw; MOTL pt no. 21R114535, dwg no. 21R 400533	L6 tank circuit
C19	Same as C7	L7 coupling
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 12 uuf, ±5%; 500 vdcw; MOTL pt no. 21R122049, dwg no. 21R400533	L7 tank circuit
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3900 uuf, ±10%; 500 vdcw; MOTL pt no. 21K837996, dwg no. 21B837745	V3 cathode bypass
C22	Same as C21	V3 screen bypass
C23	Same as C20	L8 tank circuit
C24	Same as C7	L9 coupling
C25	Same as C15	L8 feedback filter
C26	Same as C18	L9 tank circuit
C27	Same as C7	L10 coupling
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10 uuf, ±5%; 500 vdcw; MOTL pt no. 21K838686; dwg no. 21D832522	L10 tank circuit

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C29	Same as C3	V4-A grid coupling
C30	Same as C17	V4-A cathode bypass
C31	Same as C17	FL1 input coupling
C32	Same as C18	L11 tank circuit
C33	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf; ±5%; 500 vdcw; MOTL pt no. 21K850118, dwg no. 21D840044	L11 tank circuit
C34	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 15 uuf, ±5%, 500 vdcw; MOTL pt no. 21K840846, dwg no. 21D832522	V5 grid coupling
C35	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 8-50 uuf; MOTL pt/dwg no. 20C840719	V5 freq adj.
C36	CAPACITOR, FIXED, COMPOSITION: 2.2 uuf, ±10%; 500 vdcw; MOTL pt no. 21K84247, dwg no. 21C83959	V5 P/O freq adj.
C37	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 2000 uuf, ±10%, 500 vdcw; MOTL pt no. 21K837746, dwg no. 21B837745	V5 grid to meter AC bypass
C38	Same as C21	V5 screen bypass
C39	Same as C37	L15 feedback filter
C40	Same as C11	L15 tank circuit
C41	CAPACITOR, FIXED, COMPOSITION: 0.47 uuf, ±20%; 500 vdcw; MOTL pt no. 21K83994, dwg no. 21C83959	L16 coupling
C42	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20 uuf, ±5%, 500 vdcw; MOTL pt/dwg no. 21R31492	L16 tank circuit
C43	Same as C2	L16 tank circuit
C44	Same as C41	V4-B grid coupling

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C45	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840711, dwg no. 21D840044	V4-B P/O freq network
C46	Same as C45	V4-B P/O freq network
C47	Same as C15	V4-B feedback filter
C48	Same as C15	V4-B feedback filter
C49	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.25 uf, ±20%; 400 vdcw; MOTL pt/dwg no. 8A892986	V6 feedback filter
C50	Same as C17	V6 cathode bypass
C51	Same as C17	V6 screen bypass
C52	Same as C17	L17 feedback filter
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 36 uuf, ±5%; 250 vdcw; MOTL pt no. 21K834092, dwg no. 21B832883	L17 tank circuit
C54	Same as C45	V7 grid coupling
C55	Same as C17	V7 screen bypass
C56	Same as C53	L18 tank circuit
C57	Same as C17	L18 feedback filter
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC: .02 uf, -20+80%; 600 vdcw; MOTL pt/dwg no. 21B401029	V8 grid to meter AC filter
C59	Same as C15	V8 grid to meter AC filter
C60	Same as C45	V8 grid coupling
C61	Same as C17	V8 screen bypass
C62	Same as C53	L19 tank circuit
C63	Same as C17	L19 feedback filter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C64	Same as C15	V9 grid to meter AC filter
C65	Same as C45	V9 grid coupling
C66	Same as C17	V10 grid feedback filter
C67	Same as C58	V10 grid feedback filter
C68	Same as C3	V10 grid coupling
C69	Same as C17	V10 screen bypass
C70	CAPACITOR, FIXED, MICA DIELECTRIC: 240 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840048, dwg no. 21D840044	T3 tank circuit (P/O T1 discr.)
C71	Same as C17	T3 feedback filter (P/O T1 discr.)
C72	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840811, dwg no. 21D832522	T3 tank circuit (P/O T1 discr.)
C73	CAPACITOR, FIXED, MICA DIELECTRIC: 200 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840812, dwg no. 21D840044	T3 tank circuit (P/O T1 discr.)
C74	Same as C73	T3 tank circuit (P/O T1 discr.)
C75	Same as C15	T3 feedback filter (P/O T1 discr.)
C76	Same as C21	V11 output, rf filter
C77	Same as C15	V11 to meter AC filter
C78	CAPACITOR, FIXED, MICA DIELECTRIC: 800 uuf, ±5%; 300 vdcw; MOTL pt no. 21K840049, dwg no. 21D840044	V12 grid coupling
C79	Same as C17	V12 cathode bypass
C80	Same as C58	V12 screen bypass

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C81	Same as C45	V13 plate coupling
C82	Same as C37	V13 noise bypass
C83	Same as C17	V14-A noise bypass
C84	Same as C17	V14-A plate bypass
C85	Same as C21	V14-B grid coupling
C86	CAPACITOR, FIXED, ELECTROLYTIC: 5 uf, -15+100%; 150 vdcw; MOTL pt no. 23K890624, dwg no. 23C892549	V14-B cathode bypass
C87	Same as C58	V14-B feedback
C88	Same as C21	V15 grid coupling
C89	CAPACITOR, FIXED, PAPER DIELECTRIC: .02 uf, ±20%; 400 vdcw; MOTL pt no. 8K85984, dwg no. 8C890682	V15 plate bypass
C90	Same as C17	V2 fil bypass
C91	Same as C4	V1 fil bypass
C92	Same as C17	V5 fil bypass
C93	Same as C17	V4 fil bypass
C94	Same as C17	V3 fil bypass
C95	Same as C17	V6 fil bypass
C96	Same as C15	Y1 fil bypass
C97	CAPACITOR, FIXED, COMPOSITION: 1 uuf, ±.2 uuf; 500 vdcw; MOTL pt/dwg no. 21C83959	L16 bypass
C101	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf, ±10%; 500 vdcw; durez coated; rectangular body; two radial wire lead term; MOTL pt/dwg no. 21D840044	V101 freq. circuit

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C102	CAPACITOR, FIXED, MICA DIELECTRIC: 150 uuf, ±5%; 500 vdcw; MOTL pt no. 21K840047, dwg no. 21D840044	V101 freq. circuit
C103	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10 uuf, ±0.5 uuf, 500 vdcw; MOTL pt no. 21K85882, dwg no. 21B85881	V101 P/O freq adj
C104	CAPACITOR, VARIABLE, AIR DIELECTRIC: 7 uuf to 42.8 uuf; bushing mtd; MOTL pt/dwg no. 19A475604	V101 freq adj
C105	Same as C58	V101 cathode bypass
C106	Same as C17	Y101 fil bypass
C107	CAPACITOR, FIXED, MICA DIELECTRIC: 30 uuf, ±5%; 500 vdcw; MOTL pt no. 21K848156, dwg no. 21D840044	V102 tank circuit
C108	Same as C107	V102 grid coupling
C109	Same as C17	V102 grid coupling
C110	CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf, ±5%; 300 vdcw; MOTL pt no. 21K845214, dwg no. 21D840044	V102 grid filter
C111	CAPACITOR, FIXED, ELECTROLYTIC: 3 section; 15 uf at 400 vdcw, 15 uf at 400 vdcw, 10 uf at 400 vdcw; metal case, twist-lock mtg; MOTL pt no. 23K838468, dwg no. 23C893521	P/O V102 cathode bypass
C112	Same as C102	V103 grid coupling
C113	CAPACITOR, FIXED, MICA DIELECTRIC: 250 uuf, ±10%; 850 vdcw; one solder tab term; metal case, flat rectangular shape; MOTL pt/dwg no. 21A112247	V102 cathode bypass
C114	Same as C58	V103 screen bypass
C115	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 5 uuf, ±0.25 uuf; 500 vdcw; temp coeff N2200; disc type; MOTL pt no. 21K850478, dwg no. 21D832522	L106 tank circuit (P/O T101)

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C116	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3.3 uuf, ±0.5 uuf; 500 vdcw; temp coeff N2200; disc type; MOTL pt no. 21K840067, dwg no. 21D832522	L106 tank circuit (P/O T101)
C117	Same as C17	L106 feedback filter (P/O T101)
C118	Same as C116	L107 tank circuit (P/O T101)
C119	Same as C17	L107 to meter AC filter
C120	Same as C17	V104 screen bypass
C121	Same as C17	L108 feedback filter (P/O T102)
C122	Same as C116	L108 tank circuit (P/O T102)
C123	Same as C116	L109 tank circuit (P/O T102)
C124	Same as C17	L109 to meter AC filter
C125	Same as C17	V105 screen bypass
C126	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 uuf, ±10%; 500 vdcw; stand off type; durez coated; one wire positive term and one mtg stud 4-40 NC thd, negative term; MOTL pt/dwg no. 21A881306	V105 plate feedback filter
C127	Same as C126	L105 to meter AC filter
C128	Same as C17	L105 to meter AC filter
C129	Same as C58	V106 fil bypass
C130	Same as C17	V106 screen bypass
C131	Same as C104	freq adj, P/O T103
C132	Same as C17	T103 feedback filter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C133	CAPACITOR, FIXED, MICA DIELECTRIC: 5000 uuf, ±20%; 1000 vdcw; MOTL pt no. 21K893343, dwg no. 21A891905	T103 feedback filter
C134	Same as C73	L111 to meter AC filter
C135	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 7 uuf, ±0.5 uuf; 500 vdcw; temp coeff N150; tubular body; two radial wire lead term; MOTL pt/dwg no. 21B85881	V107 grid coupling
C136	CAPACITOR, VARIABLE, AIR DIELECTRIC: 1 uuf min to 10 uuf max; two metal plates each adjustable; air coupled; capacitor shipped in kit form; MOTL pt no. 1V864986	V107 plate freq adj
C137	Same as C135	V107 grid coupling
C138	CAPACITOR, FIXED, MICA DIELECTRIC: 250 uuf, ±10%; 850 vdcw; tab type; tab term positive, case is negative; incl mtg lug; MOTL pt/dwg no. 1A84707	V107 screen bypass
C139	CAPACITOR, FIXED, MICA DIELECTRIC: 500 uuf, ±20%; 2000 vdcw; CM30 case size; two axial wire lead term; MOTL pt/dwg no. 21A891905	W101, W102 feedback filter
C140	CAPACITOR, VARIABLE, AIR DIELECTRIC: 3.7 uuf min to 28.9 uuf max; MOTL pt/dwg no. 19A84648	L115 freq adj
C141	Same as C97	L117 tank circuit
C142	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 12 uuf, ±5%; 500 vdcw; NPO; disc type; two radial wire lead term; MOTL pt no. 21K847874, dwg no. 21C832520	L115 feedback filter
C143	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 24 uuf, ±5%; 500 vdcw; NPO; disc type; MOTL pt no. 21R121875, dwg no. 21R400533	L117, L118 feedback filter
C144	Same as C142	K101 bypass
C145	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 5 uuf, ±0.5 uuf; 500 vdcw; MOTL pt no. 21K86229, dwg no. 21B85881	V101 plate bypass

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C146	CAPACITOR, FIXED, ELECTROLYTIC: dual section; 40 uf, 20 uf; +100-10%; 150 vdcw ea sect; MOTL pt no. 23K832217, dwg no. 23C800111	B+ feedback filter
C147	Same as C17	V108-A grid coupling
C148	Same as C70	V108-A grid hi-freq bypass
C149	CAPACITOR, FIXED, MICA DIELECTRIC: 540 uuf, ±3%; 500 vdcw; MOTL pt no. 21K803505, dwg no. 21D891144	V108-A grid coupling
C150	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, ±10%; 500 vdcw; MOTL pt no. 21K840046, dwg no. 21D840044	V108-A grid bypass
C151	Same as C58	V109 cascade coupling
C152	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.02 uf, ±10%; 400 vdcw; MOTL pt no. 8K836754, dwg no. 8C890682	V109 cathode bypass
C153	Same as C17	V108-B grid coupling
C154	Same as C17	V102 fil bypass
C155	Same as C17	V105 fil bypass
C156	Same as C73	V108 fil bypass
C157	Same as C17	V103 fil bypass
C158	Same as C58	V103 fil bypass
C159	CAPACITOR, FIXED, MICA DIELECTRIC: 250 uuf, ±10%; 850 vdcw; tab type; tab term positive, case is negative; incl mtg lug; MOTL pt no. 1K84708, dwg no. 1A84707	V107 fil bypass
C160	Same as C58	V107 fil bypass
C161	Same as C15	V107 fil bypass
C162	Same as C17	J105-12 rf bypass

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C163	Same as C145	V101 plate bypass
C201	CAPACITOR, FIXED, OIL DIELECTRIC: 3 section; 0.5 uf, 4 uf, 6 uf, all sections +20-10%; 800 vdcw; metal case; stud mtd 8-32 NF thd; MOTL pt/dwg no. 8C838146	Transmitter B+ filtering
C202	CAPACITOR, FIXED, ELECTROLYTIC: dual section; 15 uf, +50-10%; 350 vdcw, 50 uf, +50-10%; 300 vdcw; metal case; twist-lock mtg; MOTL (contr) pt no. 23K890493, dwg no. 23C800111	Receiver B+ filtering
C501	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf, +100-15%; 25 vdcw; MOTL pt/dwg no. 23C892549	Audio coupling
C502	CAPACITOR, FIXED, PAPER DIELECTRIC: 2 uf, ±10%; 200 vdcw; MOTL pt/dwg no. 8A81769	DC isolation
C503	Same as C502	DC isolation
C801	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf +100-10%; 25 vdcw; MOTL pt/dwg no. 23C844927	Emitter bypass
CR201	RECTIFIER, METALLIC: selenium; rated 300 ma; MOTL pt/dwg no. 48B890348	+6V. relay supply
CR202	Same as CR201	+6V. relay supply
CR203	Same as CR201	+6V. relay supply
CR204	Same as CR201	+6V. relay supply
CR205	RECTIFIER, METALLIC: selenium; rated 75 ma; MOTL pt no. 48K842141, dwg no. 48D842140	Receiver B+ supply
CR206	Same as CR205	Receiver B+ supply
CR207	Same as CR205	Receiver B+ supply
CR208	Same as CR205	Receiver B+ supply
DP801	DIAPHRAGM, MICROPHONE: dynamic element; freq response 200 to 4000 cps; MOTL pt/dwg no. 59C852603	Microphone element

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E300	ANTENNA AT-853/FRC-59: 132 to 152 mc range; incl (1) one radiator, (1) one feedback and (4) four ground plane rods; mtd by (1) one pair of mtg clamps to 2-3/8 in. dia support structure; terminated w/UHF coaxial connector; MOTL model no. DS9664, dwg no. 85D858581	Transducer
F201	FUSE, CARTRIDGE: one time; slo-blo; rated 5 amp at 125 v; MOTL pt no. 65K817956, dwg no. 65B475247	Primary power for transmitter B+ supply
F202	FUSE, CARTRIDGE: one time; slo-blo; rated 1-1/4 amp at 125 v; MOTL pt no. 65K834466, dwg no. 65B475247	Primary power for filament supply
F203	FUSE, CARTRIDGE: one time; slo-blo; rated 3/4 amp at 125 v; MOTL pt no. 65K892099, dwg no. 65B475247	Primary power for relay supply
F204	FUSE, CARTRIDGE: one time; slo-blo; 4/10 amp at 125 v; MOTL pt no. 65K834465, dwg no. 65B475247	Primary power for receiver B+ supply
F205	Same as F201	6.3V AC (switched)
F701.1	FUSE, CARTRIDGE: 10 amp at 250 v; ferrule type end caps, tubular body; one time; normal blow; MOTL pt no. 65K80185, dwg no. 65B50226	Primary power (spare fuse and AC outlet panel)
F701.2	Same as F701.1	Primary power (spare fuse and AC outlet panel)
FL1	FILTER, BANDPASS: input 27,000 ohms, w/6 uuf; output 100,000 ohms, w/25 uuf; voltage attenuation max 7 db; 3.781 in. high by 2.343 in. w by 2.125 in. deep o/a incl one receptacle, female single contact and one mtg bracket w/4 mtg holes 6-32 NC-2 thd ea, spaced 0.937 in. lg by 1.500 in. C to C; metal case; hermetically sealed; potted; replaceable only as a whole item; cadmium plated and iridite finish; MOTL model no. TU145-A, dwg nos. 15C849421-housing, 15B849423-cover, 9C87120-connector Note: Model TU145-A will be replaced by MOTL model no. SK9484-W. This item is electrically and mechanically the same as model TU145-A except a diecast housing is used instead of a metal housing. dwg. nos. 15C857631-housing; 15B857633-cover & connector and 30B849414-cable	IF bandpass (V4-A output)

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
FL2	FILTER, DIRECT CURRENT POWER: ceramic body; c/o two capacitors, 100 uuf ea and one resistor 47,000 ohm; unit rated 300 vdcw; 0.687 in. lg by 0.250 in. diam o/a incl 3 wire lead term, unit rated at ±20%; MOTL pt no. 21K842354, dwg no. 21B813318	Low-pass filter for 455 KC rejection (V11 output)
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact; MOTL pt/dwg no. 9C87120	Antenna input
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 11 rd female contacts; MOTL pt/dwg no. 9C86864	Metering
J3	Not replaceable	455 KC filter output
J101	Same as J2	Metering
J102	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts; MOTL pt/dwg no. 28A483376	Power & control
J103	Not replaceable	Receiver input (P/O K101)
J104	Not replaceable	Antenna input (P/O K101)
J105	CONNECTOR, RECEPTACLE: terminal strip, 2 female contacts; MOTL pt/dwg no. 31A890581	B++ and "X" fil output
J201	CONNECTOR, RECEPTACLE, ELECTRICAL: single female contacts; MOTL pt no. 9K81685, dwg no. 9A81094	Test point for transmitter B+
J202	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 female contacts; MOTL pt/dwg no. 9A891537	Transmitter power connector
J203	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 female contacts; MOTL pt/dwg no. 9B16345	Receptacle for test microphone
J204	Same as J202	Receiver power connector
J701	CONNECTOR, RECEPTACLE, ELECTRICAL: dual, ac outlet type; contacts rated at 10 amp, 250 v; bakelite body; flange mtd; MOTL pt/dwg no. 9A891865	Primary power
K101	RELAY, ARMATURE: 1 form C; 15 ohm dc coil resistance, incl 2 coaxial connectors, 1 solder lug term; contacts encl; MOTL pt/dwg no. 59D483605	Antenna switching

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
K201	RELAY, ARMATURE: 6 vdc coil; contact arrangement, 4 form C; MOTL pt/dwg no. 59B890907	"Transmit-receive" power switching
K501	RELAY, ARMATURE: contact arrangement, 2 form A, 2 form C; DC coil resistance 6,500 ohm; open frame, telephone type; MOTL part no. 59K81303, dwg no. 59D898684	"Transmit-receive" control switching
L1	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock 0.015 in. thk by 0.093 in. wide; single layer wound; DC resistance 0.004 ohm; base stamped AD4; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K836515, dwg no. 24B824102	V1 input rf tuning (incl C1, C2)
L2	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock 0.015 in. thk by 0.093 in. wide; single layer wound; DC resistance 0.004 ohm; base stamped AD7; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K836518, dwg no. 24B824104	V1 output rf tuning (incl. C8, R4)
L3	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock 0.015 in. thk by 0.093 in. wide; single layer wound; DC resistance 0.004 ohm; base stamped BD3; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K857227, dwg no. 24B824106	V1 output rf tuning (incl. C11)
L4	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock 0.015 in. thk by 0.093 in. wide; 3 solder lug term; single layer wound; DC resistance 0.004 ohm; base stamped AD9; incl powdered iron tuning slug; MOTL pt no. 24K836520, dwg no. 24B824106	V1 output rf tuning (incl. C12)
L5	COIL, RADIO FREQUENCY: 24 turns of no. 32 AWG wire; single layer wound; DC resistance 0.34 ohm; base stamped AA2; 3 solder lug term; incl powdered iron tuning slug; MOTL pt/dwg no. 24B834778	V2 output rf tuning (incl. C14, R7)
L6	COIL, RADIO FREQUENCY: 45 turns of no. 34 AWG wire; single layer wound; DC resistance 0.71 ohm; base stamped 109; 3 solder lug term; incl powdered iron tuning slug; MOTL pt/dwg no. 24B824109	V2 output rf tuning (incl. C18)

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L7	COIL, RADIO FREQUENCY: 45 turns of no. 34 AWG wire; single layer wound; DC resistance 0.71 ohm; base stamped 110; 3 solder lug term; incl powdered iron tuning slug; MOTL pt/dwg no. 24B824110	V3 input rf tuning (incl C20)
L8	COIL, RADIO FREQUENCY: 45 turns of no. 34 AWG wire; single layer wound; DC resistance 0.71 ohm; base stamped AA3; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K834779, dwg no. 24B824113	V3 output rf tuning (incl C23, R9)
L9	COIL, RADIO FREQUENCY: 45 turns of no. 34 AWG wire, single layer wound; DC resistance 0.71 ohm; base stamped 111; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K824111, dwg no. 24B824110	V3 output rf tuning (incl C26)
L10	COIL, RADIO FREQUENCY: 45 turns of no. 34 AWG wire; single layer wound; DC resistance 0.71 ohm; base stamped 112; 3 solder lug term; incl powdered iron tuning slug; MOTL part no. 24K824112, dwg no. 24B824110	V4-A input rf tuning (incl C28)
L11	COIL, RADIO FREQUENCY: 1.14 uh, at 7.9 mc, w/cap of 358 uuf and Q of 76; single layer wound; 19 turns of no. 32 AWG wire; DC resistance 0.36 ohm; blk bakelite base, stamped AY8; phenolic form; 3 solder lug term; incl powdered iron core; MOTL pt/dwg no. 24B850089	V5 osc input rf tuning (incl C32, C33)
L12	COIL, RADIO FREQUENCY: 3.1 uh, at 12.6 mc, w/cap of 50 uuf and Q of 70; single layer wound solenoid; no. 30 AWG enamel wire; 43 turns; DC res 0.3 ohm; bakelite solid form; 2 axial wire lead term; wax dipped; MOTL pt/dwg no. 24A85541	Y1 crystal shunt
L13	COIL, RADIO FREQUENCY: 1 uh ind, at 7.9 mc, w/cap of 406 uuf and Q of 25; single layer wound; 30 turns of no. 40 AWG; DC resistance 1.05 ohm; solid bakelite form; 2 axial wire lead term; wax dipped; MOTL pt/dwg no. 24B840042	V5 cathode filter
L14	Same as L13	V5 cathode filter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L15	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock .015 in. thk by .093 in. wide; single layer wound, DC resistance 0.004 ohm; base stamped BD2; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K857226, dwg no. 24B824104	V5 osc output rf tuning (incl C40, R17)
L16	COIL, RADIO FREQUENCY: 4-1/2 turns of flat stock .015 in. thk by .093 in. wide; single layer wound; DC resistance 0.004 ohm; base stamped AD5; 3 solder lug term; incl powdered iron tuning slug; MOTL pt no. 24K836516, dwg no. 24B824102	V2 cathode input rf tuning (incl C42, C43)
L17	COIL, RADIO FREQUENCY: freq 455 KC, 630 turns of no. 40 AWG wire; universal wound; DC resistance 57 ohm; base stamped BC6; 3 solder lug term; incl powdered iron tuning slug; 1 mtg clip; MOTL pt no. 24K854048, dwg no. 24B824115	V6 output rf tuning (incl C53, R26, R27)
L18	Same as L17	V7 output rf tuning (incl C56, R30, R31)
L19	COIL, INTERMEDIATE FREQUENCY: frequency, 455 KC; 630 turns of no. 40 AWG wire; DC resistance 57.0 ohm; universal wound; phenolic coil form; base stamped AR9; 3 solder lug term; MOTL pt no. 24K840842, dwg no. 24B824115	V8 output rf tuning (incl C62, R38)
L101	REACTOR: choke; 6 mh inductance 750 turns of no. 38 AWG wire; insulation is single sodez, single nytex; universal wound; on phenolic form; two axial wire lead term; DC resistance 32 ohm; MOTL pt no. 24K483466, dwg no. 24B483465	V102 plate to grid rf fixed tuned
L102	REACTOR: choke; 2 mh; MOTL pt/dwg no. 24B483465	V102 B+ filter
L103	Same as L101	V102 grid input choke
L104	COIL, RADIO FREQUENCY: 0.67 uh w/freq. of 19.5 mc and c of 100 uuf and Q of 122; 8 turns of no. 24 AWG, plain enamel finish; two solder lug term; slug tuned but not incl; 0.500 in. dia by 1.125 in. lg o/a excl term; MOTL pt no. 24K800056, dwg no. 24C84999	V105 2nd doubler output

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L105	COIL, RADIO FREQUENCY: .0005 mh ind at 32.1 mc w/capacity of 50 uuf and Q of 146; 7 turns of no. 21 AWG wire on a 3/8 in. dia coil form; 2 solder lug term; MOTL pt/dwg no. 24C84999	V106 2nd doubler input
L106	COIL, RADIO FREQUENCY: 6.2 uh at freq of 7.9 mc w/capacity of 65 uuf and Q of 100; 38 turns of no. 32 AWG wire; solenoid wound; hollow phenolic form; MOTL pt/dwg no. 24A483468	V103 1st doubler output (P/O T101)
L107	Same as L106	V104 1st doubler input (P/O T101)
L108	COIL, RADIO FREQUENCY: .0009 mh at freq of 21 mc w/capacity of 68 uuf and Q of 92; 9-1/2 turns of no. 28 AWG wire; plain enamel finish; solenoid wound over a hollow phenolic form; MOTL pt/dwg no. 24A483467	V104 tripler output (P/O T102)
L109	Same as L108	V105 tripler input (P/O T102)
L110	COIL, RADIO FREQUENCY: 1/2 turn of no. 10 AWG wire, silver plate finish, self supporting; MOTL pt/dwg no. 24B857589	V106 doubler driver output (P/O T103)
L111	COIL, RADIO FREQUENCY: 1/2 turn of no. 10 AWG wire; silver plated, MOTL pt/dwg no. 24A857587	V107 doubler driver input
L112	COIL, RADIO FREQUENCY: 1.3 uh at freq. of 7.9 mc w/capacity of 312 uuf and Q of 60; color coded w/blue dot on wax dipped finish; 28 turns of no. 26 AWG wire on a phenolic form, 2 axial wire lead term; wire insulation is single nylon; MOTL pt/dwg no. 24A891063	T103 B++ filter
L113	Same as L112	L111 tap off filter
L114	Same as L112	V107 screen filter
L115	COIL, RADIO FREQUENCY; 2 turns of no. 10 B & S; air wound; self supporting, silver plate finish; MOTL pt no. 21K859623, dwg no. 24A891518	V107 output coupling
L116	Same as L112	V107 plate supply filter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L117	COIL, RADIO FREQUENCY: 1 uh; 5 turns of no. 16 AWG wire; air wound; self supporting; MOTL pt/dwg no. 24A851128	K101 Xmtr output filter
L118	COIL, RADIO FREQUENCY: 1 uh; 4-3/4 turns of no. 16 AWG wire; air wound; self supporting; MOTL pt/dwg no. 24A851127	K101 Xmtr output filter
L119	COIL, AUDIO FREQUENCY: choke, 2 uh, 8 turns of no. 16 AWG wire; single layer wound; air wound, self supporting; MOTL pt/dwg no. 24A845428	V107 fil choke
L201	REACTOR: filter; tapped to provide 1.5 hy and 3.5 hy inductances; MOTL pt/dwg no. 25C892463	Transmitter B+ supply filter
L202	REACTOR: filter; 2.45 hy; MOTL pt no. 25K87302, dwg no. 25B81244	Receiver B+ supply filter
LS401	LOUDSPEAKER, PERMANENT MAGNET: 3.2 ohm voice coil impedance; 5 in. rd; output, 2 watts nominal; MOTL pt/dwg no. 50B475501	Test speaker
MK801	MICROPHONE, DYNAMIC: assy; palm type; incl one stage transistorized preamplifier; MOTL model no. TU351A-N, pt no. 50K845377, dwg no. 50D845121	Test microphone
P1	Not replaceable	FL1 output connector (P/O W1)
P601	CONNECTOR, PLUG, ELECTRICAL: 12 female contacts; metal hood; MOTL pt/dwg no. 9A880725	Transmitter power connector
P602	CONNECTOR RECEPTACLE: 11 round female contacts; MOTL pt/dwg no. 9C86864	Receiver power connector
P603	CONNECTOR, RECEPTACLE: 11 rd male contacts; MOTL pt/dwg no. 28B813576	Receiver power connector
P604	CONNECTOR, PLUG, ELECTRICAL: 15 male contacts; metal hood; MOTL pt/dwg no. 28B891298	Transmitter power connector
P605	CONNECTOR, PLUG: single rd male contact; MOTL pt/dwg no. 28C42310	Connector for receiver antenna line

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
P606	CONNECTOR, PLUG: male, single contact; MOTL pt/dwg no. 28A474006	Connector for receiver antenna input
P801	CONNECTOR, PLUG: 4 rd male contacts; MOTL pt/dwg no. 28A16370	Microphone plug (P/O test mic)
Q601	TRANSISTOR: type R-52; P-N-P; MOTL pt no. 48K124299, dwg no. 48C124297	P/O test mic amplifier
R1	RESISTOR, FIXED, COMPOSITION: 100,000 ohm, ±10%; 1/2 w; MIL type RC20GF104K	J1 input impedance match
R2	RESISTOR, FIXED, COMPOSITION: 4.7 megohm, ±10%; 1/2 w; MIL type RC20GF475K	V1 grid audio peak limiter
R3	Same as R1	V1 screen dropping
R4	RESISTOR, FIXED, COMPOSITION: 12,000 ohm, ±10%; 1/2 w; MIL type RC20GF123K	V1 plate load (P/O L2)
R5	RESISTOR, FIXED, COMPOSITION: 470,000 ohm, ±10%; 1/2 w; MIL type RC20GF474K	V2 grid bias
R6	RESISTOR, FIXED, COMPOSITION: 2,200 ohm, ±10%; 1/2 w; MIL type RC20GF222K	V2 cathode bias
R7	RESISTOR, FIXED, COMPOSITION: 150,000 ohm, ±10%; 1/2 w; MIL type RC20GF154K	V2 plate load (P/O L5)
R8	Same as R6	V3 cathode bias
R9	Same as R1	V3 plate load (P/O L8)
R10	Same as R5	V4-A grid bias
R11	Same as R6	V4-A cathode bias
R12	Same as R7	V4-A plate load
R13	RESISTOR, FIXED, COMPOSITION: 220,000 ohm, ±5%; 1/2 w; MIL type RC20GF224J	V5 grid to meter voltage limiter
R14	RESISTOR, FIXED, COMPOSITION: 12,000 ohm, ±5%; 1/2 w; MIL type RC20GF123J	V5 grid bias

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R15	RESISTOR, FIXED, COMPOSITION: 47,000 ohm, ±5%; 1/2 w; MIL type RC20GF473J	V5 screen dropping
R16	RESISTOR, FIXED, COMPOSITION: 68,000 ohm, ±5%; 1/2 w; MIL type RC20GF683J	V5 screen dropping
R17	RESISTOR, FIXED, COMPOSITION: 18,000 ohm, ±10%; 1/2 w; MIL type RC20GF183K	V5 plate load (P/O L15)
R18	RESISTOR, FIXED, COMPOSITION: 180,000 ohm, ±10%; 1/2 w; MIL type RC20GF184K	V4-B plate dropping
R19	RESISTOR, FIXED, COMPOSITION: 10 megohm, ±10%; 1/2 w; MIL type RC20GF106K	V4-B grid bias
R20	RESISTOR, FIXED, COMPOSITION: 5,600 ohm, ±10%; 1/2 w; MIL type RC20GF562K	V4-B grid bias
R21	RESISTOR, FIXED, COMPOSITION: 100 ohm, ±10%; 1/2 w; MIL type RC20GF101K	B+ filtering
R22	RESISTOR, FIXED, COMPOSITION: 100,000 ohm, ±5%; 1/2 w; MIL type RC20GF104J	V6 grid bias
R23	RESISTOR, FIXED, COMPOSITION: 220 ohm, ±10%; 1/2 w; MIL type RC20GF221K	V6 cathode bias
R24	RESISTOR, FIXED, COMPOSITION: 8.2 megohm, ±10%; 1/2 w; MIL type RC20GF825K	V6 feedback voltage limiter
R25	RESISTOR, FIXED, COMPOSITION: 82,000 ohm, ±10%; 1/2 w; MIL type RC20GF823K	V6 screen dropping
R26	RESISTOR, FIXED, COMPOSITION: 68,000 ohm, ±10%; 1/2 w; MIL type RC20GF683K	V6 plate load
R27	Same as R26	V6 plate load
R28	Same as R22	V7 grid bias
R29	Same as R7	V7 screen dropping
R30	Same as R22	V7 plate load

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R31	Same as R22	V7 plate load
R32	RESISTOR, FIXED, COMPOSITION: 18,000 ohm, ±5%; 1/2 w; MIL type RC20GF183J	L18 tank circuit shunt
R33	RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%; 1/2 w; MIL type RC20GF105K	V8 grid feedback voltage limiter
R34	RESISTOR, FIXED, COMPOSITION: 1.5 megohm, ±5%; 1/2 w; MIL type RC20GF155J	V8 grid to meter voltage limiter
R35	RESISTOR, FIXED, COMPOSITION: 270,000 ohm, ±10%; 1/2 w; MIL type RC20GF274K	V8 grid bias
R36	RESISTOR, FIXED, COMPOSITION: 120,000 ohm, ±10%; 1/2 w; MIL type RC20GF124K	V8 screen dropping
R37	RESISTOR, FIXED, COMPOSITION: 56,000 ohm, ±5%; 1/2 w; MIL type RC20GF563J	V8 screen dropping
R38	RESISTOR, FIXED, COMPOSITION: 33,000 ohm, ±10%; 1/2 w; MIL type RC20GF333K	V8 plate load
R39	RESISTOR, FIXED, COMPOSITION: 1.8 megohm, ±5%; 1/2 w; MIL type RC20GF185J	V9 grid to meter voltage limiter
R40	Same as R22	V9 grid bias
R41	Same as R7	V9 screen dropping
R42	Same as R33	V10 grid feedback filter
R43	Same as R33	V10 grid feedback filter
R44	Same as R22	V10 grid bias
R45	RESISTOR, FIXED, COMPOSITION: 15,000 ohm, ±10%; 1/2 w; MIL type RC20GF153K	V10 screen dropping
R46	RESISTOR, FIXED, COMPOSITION: 47,000 ohm, ±10%; 1/2 w; MIL type RC20GF473K	V10 screen dropping
R47	RESISTOR, FIXED, COMPOSITION: 6,800 ohm, ±10%; 1/2 w; MIL type RC20GF682K	V10 plate load (P/O T1)

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R48	RESISTOR, FIXED, COMPOSITION: 22,000 ohm, ±10%; 1/2 w; MIL type RC20GF223K	V10 plate load (P/O T1)
R49	RESISTOR, FIXED, COMPOSITION: 2.2 megohm, ±10%; 1/2 w; MIL type RC20GF225K	V11 plate to meter voltage limiter
R50	Same as R37	V11 DC path and load res
R51	Same as R37	V11 DC path and load res
R52	RESISTOR, FIXED, COMPOSITION: 680,000 ohm, ±10%; 1/2 w; MIL type RC20GF684K	V11 output constant load
R53	Same as R34	V11 output to meter voltage limiter
R54	RESISTOR, VARIABLE: 200,000 ohm, ±20%; 1/4 w; MOTL pt no. 18K845110, dwg no. 18C840726	V11 output "Audio Level Control"
R55	Same as R46	V12 grid bias
R56	RESISTOR, FIXED, COMPOSITION: 680 ohm, ±10%; 1/2 w; MIL type RC20GF681K	V12 cathode bias
R57	Same as R7	V12 cathode input voltage limiter
R58	RESISTOR, FIXED, COMPOSITION: 220,000 ohm, ±10%; 1/2 w; MIL type RC20GF224K	V12 screen dropping
R59	Same as R58	V12 screen dropping
R60	Same as R7	V12 plate load
R61	Same as R33	V13 current limiter
R62	RESISTOR, FIXED, COMPOSITION: 560,000 ohm, ±5%; 1/2 w; MIL type RC20GF564J	V13 DC path and load res
R63	RESISTOR, FIXED, COMPOSITION: 3.3 megohm, ±10%; 1/2 w; MIL type RC20GF335K	V14-A voltage limiter
R64	RESISTOR, FIXED, COMPOSITION: 12 megohm, ±10%; 1/2 w; MIL type RC20GF126K	V14-A feedback limiter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R65	Same as R52	V14-A plate load
R66	RESISTOR, FIXED, COMPOSITION: 6.8 megohm, ±10%; 1/2 w; MIL type RC20GF685K	V14-B grid bias
R67	RESISTOR, FIXED, COMPOSITION: 3.9 megohm, ±10%; 1/2 w; MIL type RC20GF395K	V14-B grid bias
R68	Same as R22	V14-A plate load
R69	RESISTOR, FIXED, COMPOSITION: 27,000 ohm, ±10%; 1/2 w; MIL type RC20GF273K	V14-B cathode bias
R70	RESISTOR, FIXED, COMPOSITION: 1,800 ohm, ±10%; 1/2 w; MIL type RC20GF182K	V14-B cathode bias
R71	Same as R69	V14-B plate load
R72	Same as R48	V14-B plate load
R73	Same as R5	V15 grid bias
R74	RESISTOR, FIXED, COMPOSITION: 1.5 megohm, ±10%; 1/2 w; MIL type RC20GF155K	V11 grid bias
R75	Same as R38	V11 output filter
R101	Same as R26	V101 screen dropping
R102	Same as R46	V101 grid bias
R103	Same as R21	V101 cathode bias
R104	RESISTOR, FIXED, COMPOSITION: 10,000 ohm, ±10%; 1/2 w; MIL type RC20GF103K	V102 plate tank circuit
R105	Same as R38	V102 grid bias
R106	Same as R18	V102 grid bias
R107	RESISTOR, FIXED, COMPOSITION: 1,500 ohm, ±10%; 1/2 w; MIL type RC20GF152K	V102 cathode bias

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R108	Same as R5	V103 grid bias
R109	Same as R1	V103 screen dropping
R110	Same as R1	V103 screen dropping
R111	RESISTOR, FIXED, COMPOSITION: 1,000 ohm, ±10%; 2 w; MIL type RC42GF102K	V103 plate load (P/O T101)
R112	RESISTOR, FIXED, COMPOSITION: 270,000 ohm, ±5%; 1/2 w; MIL type RC20GF274J	L107 to meter voltage limiter (P/O T101)
R113	RESISTOR, FIXED, COMPOSITION: 3,300 ohm, ±5%; 1/2 w; MIL type RC20GF332J	L107 to meter voltage limiter (P/O T101)
R114	RESISTOR, FIXED, COMPOSITION: 56,000 ohm, ±10%; 1/2 w; MIL type RC20GF563K	V104 screen dropping
R115	Same as R111	V104 plate load
R116	RESISTOR, FIXED, COMPOSITION: 180,000 ohm, ±5%; 1/2 w; MIL type RC20GF184J	L109 to meter voltage limiter (P/O T102)
R117	RESISTOR, FIXED, COMPOSITION: 1,200 ohm, ±5%; 1/2 w; MIL type RC20GF122J	L109 to meter voltage limiter (P/O T102)
R118	Same as R38	V105 screen dropping
R119	RESISTOR, FIXED, COMPOSITION: 270 ohm, ±10%; 1 w; MIL type RC32GF271K	V105 plate load
R120	RESISTOR, FIXED, COMPOSITION: 2.7 megohm, ±5%; 1/2 w; MIL type RC20GF275J	L105 to meter voltage limiter
R121	RESISTOR, FIXED, COMPOSITION: 27,000 ohm, ±5%; 1/2 w; MIL type RC20GF273J	V106 grid bias
R122	RESISTOR, FIXED, COMPOSITION: 82,000 ohm, ±10%; 2 w; MIL type RC42GF823K	V106 screen dropping
R123	RESISTOR, FIXED, WIRE WOUND: 3,000 ohm, ±10%; 25 w; hollow ceramic body, vitreous enamel finish, two radial solder lug term, MOTL pt/dwg no. 17C83436	V106 screen dropping

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R124	RESISTOR, FIXED, COMPOSITION: 3,900 ohm, ±10%; 2 w; MIL type RC42GF392K	V107 grid bias
R125	RESISTOR, FIXED, COMPOSITION: 2.7 megohm, ±10%; 1/2 w; MIL type RC20GF275K	L111 to meter voltage limiter
R126	Same as R124	V107 screen dropping
R127	RESISTOR, FIXED, COMPOSITION: 27,000 ohm, ±10%; 2 w; MIL type RC42GF273K	V107 screen dropping
R128	Same as R124	V107 screen dropping
R129	RESISTOR, FIXED, WIRE WOUND; 4 ohm, ±2%; 1 w; MOTL pt no. 17K892469, dwg no. 17A892468	V107 plate load
R130	Same as R1	L115 DC path
R131	RESISTOR, FIXED, COMPOSITION: 47,000 ohm, ±10%; 2 w; MIL type RC42GF473K	J105-11 B+ voltage divider for MIC DC
R132	Same as R131	J105-11 B+ voltage divider for MIC DC
R133	RESISTOR, FIXED, COMPOSITION: 560 ohm, ±10%; 1/2 w; MIL type RC20GF561K	B+ voltage limiter to J105-10 "Audio"
R134	Same as R6	J105-11 B+ voltage divider for MIC DC
R135	Same as R74	V108-A grid input filter
R136	Same as R121	V108-A grid bias
R137	Same as R16	V108-A grid bias
R138	RESISTOR, FIXED, COMPOSITION: 560 ohm, ±5%, 1/2 w; MIL type RC20GF561J	V108-A cathode bias
R139	Same as R114	V108-A plate load
R140	RESISTOR, FIXED, COMPOSITION: 4700 ohm, ±10%; 1/2 w; MIL type RC20GF472K	V108-A plate load

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R141	Same as R62	V109 plate load voltage divider
R142	Same as R62	V109 plate load
R143	Same as R16	V109 plate load voltage divider
R144	Same as R1	V109 cathode bias
R145	Same as R1	V109 cathode bias
R146	Same as R104	V109 cathode output voltage limiter
R147	RESISTOR, VARIABLE: 300,000 ohm, ±20%; 1/4 w; MOTL pt no. 18K892291, dwg no. 18B483634	V108-B grid "IDC control"
R148	RESISTOR, FIXED, COMPOSITION: 1000 ohm, ±10%; 1/2 w; MIL type RC20GF102K	V108-B grid bias
R149	RESISTOR, FIXED, COMPOSITION: 39000 ohm, ±10%; 1/2 w; MIL type RC20GF393K	V108-B plate load
R150	Same as R148	V108-B cathode bias
R201	RESISTOR, FIXED, COMPOSITION: 22 ohm, ±10%; 1 w; MIL type RC32GF220K	Current limiting (V201)
R202	Same as R201	Current limiting (V201)
R203	Same as R201	Current limiting (V202)
R204	Same as R201	Current limiting (V202)
R205	RESISTOR, FIXED, COMPOSITION: 330,000 ohm, ±10%; 2 w; MIL type RC42GF334K	Bleeder (transmitter B+)
R206	RESISTOR, FIXED, WIRE WOUND: 1800 ohm, ±10%; 35 w; MOTL pt/dwg no. 17B892965	Voltage dropping
R207	Same as R206	Voltage dropping

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R208	RESISTOR, FIXED, WIRE WOUND: 50 ohm, ±10%; 10 w; MOTL pt no. 17K81760, dwg no. 17D80747	Transmitter bias
R209	RESISTOR, FIXED, COMPOSITION: 220,000 ohm, ±10%; 1 w; MIL type RC32GF224K	Bleeder (receiver B+)
R210	RESISTOR, FIXED, COMPOSITION: 10 ohm, ±10%; 1/2 w; MIL type RC20GF100K	Current limiting (receiver B+)
R211	Same as R23	Receiver B+ discharge (active only under transmit condition)
R501	Not used	
R502	Same as R21	"Anti-shorting" for test mic. audio output
R503	RESISTOR, VARIABLE: wire wound; 10,000 ohm, ±10%; 4 w; MOTL part no. 18K898247, dwg no. 18A898175	Squelch control
R504	RESISTOR, FIXED, COMPOSITION: 10 ohm, ±10%; 2 w; MIL type RC42GF100K	Audio voltage divider
R505	RESISTOR, FIXED, WIRE WOUND: 4 ohm, ±2%; 3 w; MOTL pt/dwg no. 17B821901	Audio voltage divider
R801	Same as R140	Voltage divider (transistor bias)
R802	RESISTOR, FIXED, COMPOSITION: 3300 ohm, ±10%; 1/2 w; MIL type RC20GF332K	Voltage divider (transistor bias)
R803	RESISTOR, FIXED, COMPOSITION: 180 ohm, ±10%; 1/2 w; MIL type RC20GF181K	Transistor emitter current limiting
S101	SWITCH, TOGGLE: S.P.S.T.; bushing mtd; bat handle; 2 solder lug term; plastic body; MOTL pt/dwg no. 40A85655	"HI-LO" switch
S401	Same as S101	Test speaker "ON-OFF" switch

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
S601	SWITCH, PUSH: S. P. S. T.; normally open; contacts rated at 6 ampere at 125 v ac; metal trigger actuator; 2 screw term; bakelite body; MOTL pt/dwg no. 40A80237	Front door interlock switch
S602	Same as S601	Rear door interlock switch
S801	SWITCH, PUSH: D. P. S. T.; does not incl switch button; MOTL pt/dwg no. 40C857174	"Push-to-talk" switch on test mic
T1	TRANSFORMER, DISCRIMINATOR: frequency 455 KC; includes resistors and capacitors; adjustable slug tuning; powdered iron core; 6 solder lug terminals; 2 mtg studs; metal case; MOTL pt no. 1V842353	455 KC discriminator
T2	TRANSFORMER, AUDIO FREQUENCY: output type; primary impedance 5000 ohm, DC resistance 148 ohm at 25°C; secondary impedance 3.2 ohm, DC resistance 0.23 ohm; frequency response 100 - 5000 cps; metal case; 4 wire lead term; MOTL pt no. 25K847479, dwg no. 25C847478	Audio output
T3	TRANSFORMER, RADIO FREQUENCY: freq 455 KC for each winding; primary, 245 turns of 7/44 litz wire, universal wound; DC resistance 8.5 ohm; secondary, 400 turns of 7/44 litz wire, universal wound; DC resistance 15.5 ohm; phenolic tube form; 1-9/32 in. lg by 5/8 in. diam o/a incl form; MOTL pt/dwg no. 24B821996	Discriminator coupling (P/O T1)
T101	TRANSFORMER, RADIO FREQUENCY: incl coils, capacitors and resistors, metal shield incl; MOTL pt. no. 24B857547	V103 to V104 coupling
T102	TRANSFORMER, RADIO FREQUENCY: incl capacitors, coils and resistors; metal shield incl; MOTL pt no. 24B857548	V104 to V105 coupling
T103	TRANSFORMER, RADIO FREQUENCY: incl capacitors, coils and resistors; MOTL pt no. 1V857628	V106 to V107 coupling
T201	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: pri, 117 VAC at 50-60 cps; sec no. 1, 670 v at 370 ma; sec. no. 2, 6.3 v at 1 amp; MOTL pt/dwg no. 25C891906	Transmitter B+ supply

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
T202	TRANSFORMER, POWER, STEP-DOWN: pri, 117 v at 50-60 cps; sec no. 1, 16 v at 0.75 amp; sec no. 2, 6.3 v at 5 amp; MOTL pt/dwg no. 25B483001	Rectifier and transmitter filament supply
T203	TRANSFORMER, POWER, STEP-DOWN: pri 117 v at 50-60 cps; sec no. 1, 8.5 v at 1 amp each side of ct; sec no. 2, 6.3 v at 4.5 amp; MOTL pt/dwg no. 25C891531	Relay supply
T204	TRANSFORMER, POWER, STEP-UP: pri 117 v at 50-60 cps; sec 200 v at 55 ma; MOTL pt/dwg no. 25B813404	Receiver B+ supply
T501	TRANSFORMER, AUDIO FREQUENCY: line type; pri two 125 ohm windings to match 500 ohm line; sec no. 1, 600 ohm, CT. 50 ohm; sec no. 2, 3 ohm; MOTL pt/dwg no. 25B811697	Line transformer
TB201	TERMINAL BOARD: 12 double screw terminals on phenolic base; MOTL pt/dwg no. 31B880805	Remote control connections
TB202	TERMINAL BOARD: 15 screw terminals on phenolic base; MOTL pt/dwg no. 31B892834	Remote control connections
TB501	TERMINAL BOARD: 24 screw type terminals; MOTL pt/dwg no. 31B81754	Remote control connections
V1	ELECTRON TUBE: sharp-cutoff rf pentode; type 6AK5	rf amplif
V2	ELECTRON TUBE: high-frequency triode; type 6AB4	1st mixer
V3	ELECTRON TUBE: sharp-cutoff rf pentode; type 6BH6	12 mc 1st IF mixer
V4	ELECTRON TUBE: high-frequency twin triode; type 12AT7	2nd mixer and 2nd osc
V5	ELECTRON TUBE: sharp-cutoff rf pentode; type 6CB6	1st osc and multiplier
V6	Same as V5	455 KC, IF Ampl-1
V7	Same as V5	455 KC, IF Ampl-2
V8	Same as V5	455 KC, IF Ampl-3
V9	Same as V3	1st limiter

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
V10	ELECTRON TUBE: remote-cutoff rf pentode; type 6BJ6	2nd limiter
V11	ELECTRON TUBE: twin diode; type 6AL5	discr
V12	Same as V3	Noise amplif
V13	ELECTRON TUBE: medium - mu triode; type 6C4	noise rect
V14	Same as V4	DC amplif and 1st audio
V15	ELECTRON TUBE: beam power amplifier; type 6AQ5	power amplif
V101	TUBE, ELECTRON: power amplifier pentode; type 6AK6	osc
V102	ELECTRON TUBE: sharp-cutoff rf pentode; type 7V7	modulator
V103	Same as V102	buffer and 1st doubler
V104	ELECTRON TUBE: beam power amplifier; type 7C5	tripler
V105	Same as V104	2nd doubler
V106	ELECTRON TUBE: vhf beam power amplifier; type 2E26	doubler driver
V107	ELECTRON TUBE: push-pull rf beam power amplifier; type 829B	power amplif
V108	TUBE, ELECTRON: high - mu twin triode; type 12AX7	amplif
V109	Same as V11	clipper
V201	ELECTRON TUBE: full-wave high vacuum rectifier; type 5R4GY	Transmitter B+ supply rectifier
V202	Same as V201	Transmitter B+ supply rectifier
W1	CABLE ASSEMBLY, RADIO FREQUENCY: RG-58A/U coaxial cable, 4 in. lg; incl one CONNECTOR PLUG, single contact, ref symbol P1; MOTL pt/dwg no. 30B849414	FL1 output cable

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
W601	CABLE ASSEMBLY, RADIO FREQUENCY: c/o RG-58/U coaxial cable, one CONNECTOR, PLUG Navy type CPH49190, 1 male contact and one CONNECTOR PLUG 1 male contact; 33-1/2 in. lg incl terminations; MOTL pt no. 1C891948	Receiver antenna input lead
W602	CABLE ASSEMBLY, POWER, ELECTRICAL: c/o two no. 18 AWG; ten no. 20 AWG, one shielded conductor, all conductors are stranded, one CONNECTOR, PLUG; 12 female contacts and one CONNECTOR, PLUG; 15 male contacts; 33 in. lg o/a incl terminations; MOTL pt no. 1V858647	Transmitter power connector cable
W603	CABLE ASSEMBLY, POWER ELECTRICAL: c/o six no. 20 AWG, stranded; one CONNECTOR, PLUG, 11 male contacts and one CONNECTOR, PLUG, 15 female contacts; 12 in. lg o/a incl terminations; MOTL pt no. 1V858646	Receiver power connector cable
W604	WIRING HARNESS, BRANCHED: c/o three no. 18 AWG, five no. 20 AWG; one conductor shielded and two SWITCH, PUSH S. P. S. T.; all conductors are stranded; 70 in. lg o/a incl terminations and switches; all conductors terminated w/spade lugs; MOTL pt no. 1V892589	Miscellaneous intercabling connection cable
W801	CORD, ASSEMBLY, ELECTRICAL: stranded; coiled; 4 conductors; 20.5 in. lg; MOTL pt/dwg no. 30C852740	Test microphone cord
XF201	FUSEHOLDER: extractor post type; bayonet base; bushing mtd; MOTL pt/dwg no. 9B820279	Primary power (T201)
XF202	Same as XF201	Primary power (T202)
XF203	Same as XF201	Primary power (T203)
XF204	FUSEHOLDER: single fuse clip type; MOTL pt/dwg no. 31A824974	Primary power (T204)
XF205	Same as XF201	Filament power (T201)
XF701	FUSEHOLDER: accommodates two 9/16 in. dia by 2 in. lg ferrule fuses; porcelain body; 4 screw type term; MOTL pt/dwg no. 67B80179	Primary power

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
XV1	SOCKET, ELECTRON TUBE: 7 silver plated phosphor bronze contacts; MOTL pt/dwg no. 9C834083	V1 receptacle
XV2	SOCKET, ELECTRON TUBE: 7 silver plated phosphor bronze contacts; MOTL pt no. 9K87124, dwg no. 9C87123	V2 receptacle
XV3	Same as XV2	V3 receptacle
XV4	SOCKET, ELECTRON TUBE: 9 silver plated phosphor bronze contacts; MOTL pt/dwg no. 9C881243	V4 receptacle
XV5	Same as XV1	V5 receptacle
XV6	SOCKET, ELECTRON TUBE: 7 solder coated brass alloy contacts; MOTL pt no. 9K849460, dwg no. 9C834083	V6 receptacle
XV7	Same as XV6	V7 receptacle
XV8	SOCKET, ELECTRON TUBE: 7 silver plated phosphor bronze contacts; MOTL pt/dwg no. 9C87123	V8 receptacle
XV9	Same as XV8	V9 receptacle
XV10	Same as XV8	V10 receptacle
XV11	Same as XV8	V11 receptacle
XV12	Same as XV8	V12 receptacle
XV13	Same as XV8	V13 receptacle
XV14	SOCKET, ELECTRON TUBE: 7 silver plated phosphor bronze contacts; MOTL pt/dwg no. 9C86868	V14 receptacle
XV15	Same as XV8	V15 receptacle
XV101	Same as XV1	V101 receptacle
XV102	SOCKET, ELECTRON TUBE: 8 cont; MOTL pt/dwg no. 9C83952	V102 receptacle
XV103	Same as XV102	V103 receptacle
XV104	Same as XV102	V104 receptacle

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
XV105	Same as XV102	V105 receptacle
XV106	SOCKET, ELECTRON TUBE: 8 rd female contacts on brown bakelite wafer base; MOTL pt/dwg no. 9C890001	V106 receptacle
XV107	SOCKET, ELECTRON TUBE: 7 clip type, phosphor bronze, silver plated contacts; steatite body; glazed finish; incl 7 phosphor bronze, silver plated tube retainer springs; flange mtd, 4 mtg holes 0.185 in. dia each, spaced 2.312 in. c to c; 2.750 in. w by 2.750 in. high by 2.062 in. deep o/a; MOTL pt/dwg no. 9B893210	V107 receptacle
XV108	SOCKET, ELECTRON TUBE: 9 contacts; MOTL pt no. 9K832481, dwg no. 9C881243	V108 receptacle
XV109	Same as XV1	V109 receptacle
XV201	SOCKET, ELECTRON TUBE: octal; 8 rd female contacts; MOTL pt/dwg no. 9B6763	V201 receptacle
XV202	Same as XV201	V202 receptacle
XY1	SOCKET, CRYSTAL; 4 rd contact; bakelite body, 1 mtg hole req'd; MOTL part no. 9K857508, dwg no. 9B30451	Y1 receptacle
XY2	SOCKET, CRYSTAL: two silver plated, phosphor bronze contacts; black durez body; MOTL pt no. 9K861367, dwg no. 9C824969	Y2 receptacle
XY3	Same as XY1	Y3 receptacle
Y1	CRYSTAL, UNIT QUARTZ: freq 30,000 - 35,000 KC; ±.002% tol.; operating frequency must be specified; etched plate; operating temp range, -40°C to +100°C; 3rd overtone mode of operation; metal case; hermetically sealed; plug in base; incl 6 volt integral heater; four rd pin contacts; MOTL pt no. RM25 Spec no. 12M848526	Y1 crystal P/O 1st freq osc circuit

TABLE 1-2. TABLE OF REPLACEABLE PARTS Cont'd

REF. DESIG.	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
Y2	CRYSTAL, UNIT QUARTZ: freq 12455.00 KC ±.0032% tol; etched plate; operating temp range -30°C to +80°C; fundamental mode of oper; metal case, hermetically sealed; plug in base; two rd pin type contacts; MOTL pt no. G03/12,455.00 KC, dwg no. 69D824679	Y2 crystal P/O 2nd osc circuit
Y101	CRYSTAL, UNIT QUARTZ: freq 5,500-6,333 KC; .002% tol; operating frequency must be specified; etched plate; operating temp range -40°C to +100°C; fundamental mode of oper; metal case; hermetically sealed; plug in base; 4 rd pin type contacts; incl 6.3 v heater element; MOTL pt no. R03, dwg no. 69D848893	Y101 crystal P/O freq osc circuit